

**SUMMARY OF TOTAL COSTS
CAPITAL AND NET PRESENT VALUE
(From Appendix M, RI/FS)**

Activity	Assumptions	Years	total
Capital - Institutional Controls	7% discount	2	16,049,000
Capital - Point of Use Management	7% discount	2	17,528,000
Capital - Wells and Treatment	7% discount		40,715,000
O+M Source Control @ 1,844,000/yr	7% discount	1,844,000/yr for perpetuity	26,343,000
O+M Institutional Controls	none		
O+M Point of Use @64,000/yr	7% discount	64,000/yr for perpetuity	914,000
O+M Wells and Treatment			
Sulfate extraction and RO	7% discount	2,826,000/yr for perpetuity	40,372,000
Acid extraction, NF, RO	7% discount	5,079,000/yr for 21 years	\$55,031,000
TOTAL NET PRESENT VALUE			\$197M

4. **Expected Outcomes of the Selected Remedy:**

The overall objective of the selected remedy in conjunction with the NRD settlement action is to remediate the aquifer so that full unrestricted use of the ground water by public and municipal well owners is achieved. Because this will take a long time, perhaps 50 - 150 years or longer, it is also necessary to contain the plume from further migration so that the situation does not become worse and private well owners are not exposed to unacceptable concentrations of contaminants. Containment will also prevent contamination of the Jordan River and exposure of aquatic organisms to the plume contaminants. Until the aquifer meets drinking water standards, water treated as a part of this program can be used by the public.

The final cleanup levels for the remedy are given in the following table:

FINAL CLEANUP LEVELS FOR THE SELECTED REMEDY

Contaminant	Remediation Level throughout acid plume	Containment Level at Kennecott property line downgradient of Zone A (as of 12-13-2000)	Treatment Level for RO treatment plant
Basis	health based levels from site specific risk assessment	health based levels from site specific risk assessment	ARAR, state primary and secondary drinking water standards.
acidity	pH = 6.5 - 8.5	pH = 6.5 - 8.5	pH = 6.5 - 8.5
Arsenic	0.05 mg/l	0.05 mg/l	0.05 mg/l
Barium	2 mg/l	2 mg/l	2 mg/l
Cadmium	0.005 mg/l	0.005 mg/l	0.005 mg/l
Copper	1.3 mg/l	1.3 mg/l	1.0 mg/l
Fluoride	4 mg/l	4 mg/l	2 mg/l
Lead	0.015 mg/l	0.015 mg/l	0.015 mg/l
Nitrate	10 mg/l	10 mg/l	10 mg/l
Selenium	0.05 mg/l	0.05 mg/l	0.05 mg/l
Nickel	0.1 mg/l	0.1 mg/l	0.1 mg/l
Aluminum	-	-	0.05 - 2 mg/l
Chloride	-	-	250 mg/l
Manganese	-	-	0.05 mg/l
Silver	-	-	0.10 mg/l
Sulfate	1500 mg/l, active CERCLA remediation 500 mg/l, passive CERCLA action via natural attenuation	1500 mg/l	250 mg/l

Contaminant	Remediation Level throughout acid plume	Containment Level at Kennecott property line downgradient of Zone A (as of 12-13-2000)	Treatment Level for RO treatment plant
TDS	-	-	500 mg/l
Zinc	-	-	5 mg/l

M. Statutory Determinations

The following describes how the selected remedy will satisfy the statutory requirement of the nine selection criteria specified in the National Contingency Plan

1. **Protection of Human Health and the Environment:** Human health is protected by the selected remedy both short term and long term. Short term protection is achieved by limiting exposure of residents to contaminated ground water through use of institutional controls, point-of-use management and by containment of the plume from further migration. Environmental protection is achieved by containment of the plume such that the contaminants do not reach the exposure point at the Jordan River. Long term protection of both human health and the environment is achieved by active remediation of the plume so that the waters can be returned to beneficial use without restrictions.
2. **Compliance with Applicable or Relevant and Appropriate Requirements (ARARs):** Section 121(d) of CERCLA, 42 U.S.C. § 9621(d), the National Oil and Hazardous Substances Pollution Contingency Plan (the "NCP"), 40 CFR Part 300 (1990), and guidance and policy issued by EPA require that remedial actions under CERCLA comply with substantive provisions of applicable or relevant and appropriate standards, requirements, criteria, or limitations ("ARARs") from State of Utah and federal environmental laws and State facility siting laws during and at the completion of the remedial action. These requirements are threshold standards that any selected remedy must meet.

This document identifies ARARs that apply to the activities to be conducted under the Southwestern Jordan River Valley Ground Water Plumes Operable Unit 2 remedial action. The ARARs or groups of related ARARs contained in Appendix A are each identified by a statutory or regulatory citation, followed by a brief explanation of the ARAR and how and to what extent the ARAR is expected to apply to the activities to be conducted under this remedial action.

Substantive provisions of the requirements listed in Appendix A are identified as ARARs pursuant to 40 CFR § 300.400. ARARs that are within the scope of this remedial action must be attained during and at the completion of the remedial action.

Types of ARARs: ARARs are either "applicable" or "relevant and appropriate." Both types of requirements are mandatory under Superfund guidance. Applicable requirements are those cleanup standards, standards of control, and other substantive requirements, criteria or limitations promulgated under federal environmental or state environmental facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other

circumstance found at a CERCLA site. Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be applicable.

Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive requirements, criteria or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not "applicable" to hazardous substances, pollutants, contaminants, remedial actions, locations, or other circumstances at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Only those state standards that are identified in a timely manner and are more stringent than federal requirements may be relevant and appropriate.

The determination that a requirement is relevant and appropriate is a two-step process: (1) determination if a requirement is relevant and (2) determination if a requirement is appropriate. In general, this involves a comparison of a number of site-specific factors, including an examination of the purpose of the requirement and the purpose of the proposed CERCLA action; the medium and substances regulated by the requirement and the proposed requirement; the actions or activities regulated by the requirement and the remedial action; and the potential use of resources addressed in the requirement and the remedial action. When the analysis results in a determination that a requirement is both relevant and appropriate, such a requirement must be complied with to the same degree as if it were applicable.

ARARs are contaminant, location, or action specific. Contaminant specific requirements address chemical or physical characteristics of compounds or substances on sites. These values establish acceptable amounts or concentrations of chemicals which may be found in or discharged to the ambient environment.

Location specific requirements are restrictions placed upon the concentrations of hazardous substances or the conduct of cleanup activities because they are in specific locations. Location specific ARARs relate to the geographical or physical positions of sites, rather than to the nature of contaminants at sites.

Action specific requirements are usually technology based or activity based requirements or limitations on actions taken with respect to hazardous substances, pollutants or contaminants. A given cleanup activity will trigger an action specific requirement. Such requirements do not themselves determine the cleanup alternative, but define how chosen cleanup methods should be performed.

Many requirements listed as ARARs are promulgated as identical or near identical requirements in both federal and state law, usually pursuant to delegated environmental programs administered by EPA and the state. The Preamble to the

NCP provides that such a situation results in citation to the state provision and treatment of the provision as a federal requirement.

Also contained in this list are policies, guidance or other sources of information which are "to be considered" in the selection of the remedy and implementation of the ROD. Although not enforceable requirements, these documents are important sources of information which EPA and the UDEQ may consider during selection of the remedy, especially in regard to the evaluation of public health and environmental risks; or which will be referred to, as appropriate, in selecting and developing cleanup actions.

This list in Appendix A constitutes EPA's and UDEQ's formal identification and detailed description of ARARs for the remedial action at the Kennecott South Zone Site, Southwestern Jordan River Valley Ground Water Plumes Operable Unit 2.

3. Cost Effectiveness: A Cost Effective remedy in the Superfund program is one whose costs are proportional to its overall effectiveness. This includes long term and short term effectiveness and reduction of toxicity, mobility, and volume through treatment.

At this site, the remedial alternatives fall into two groups:

(1) Alternatives 1, 2, and 3 contain no active remediation component, but rely on personal controls, institutional controls or replacement waters to prevent exposure to the citizenry. The plume continues to move downgradient until it discharges to the Jordan River contaminating more and more of the aquifer as it moves. These alternatives are relatively low in cost, but do not protect the environment long term. In addition, the ground waters are not returned to beneficial use.

(2) Alternatives 4, 5, and 6 contain an active remediation component and achieve containment of the plume and eventual remediation of the aquifer. In addition, Alternative 4 might not be effective in containing the plume in long term. Although Alternative 4 could be slower than the Alternatives 5 and 6, the results are roughly equivalent in terms of effectiveness, permanence, and reduction of toxicity, mobility, and volume through treatment in the short term. Alternative 5 is the most cost effective of the active remediation alternatives. It has an added advantage over Alternative 6 producing no sludges requiring disposal prior to mine closure. All alternatives would have to deal with treatment residuals post mine closure, but because Alternatives 5 and 6 would be faster, the amount of residuals would probably be less.

4. Utilization of Permanent solutions and alternative Treatment to the Maximum Extent Practicable: Alternative 5 takes advantage of an emerging technology using membrane technology, such as nanofiltration. Since it achieved the same goals as

the more traditional treatment technologies at a lower cost, it was selected. The selected remedy fulfills the requirement for use of innovative technologies to the maximum extent practicable. It also provides a permanent solution to the ground water problem although this could take 50 years or longer.

5. **Preference for Treatment as a Principal Element:** The selected remedy uses treatment as a principal element in remediation of the aquifer and meets the statutory requirement. Monitored Natural Attenuation (MNA) is used as a supplement to the active restoration only after the contaminants in the plume have been reduced to levels that are protective of human health and the environment. The extended time frame for MNA is reasonable in light of the uncertainties as to whether additional active restoration of the remaining sulfate would decrease the time required to meet MCLs as compared to MNA.
6. **Five-year Review Requirements:** Since hazardous substance, pollutants, and contaminants will remain on-site in the aquifer while the long-term remedial action is on-going, five year reviews are required at this site to determine if the remedy continues to remain effective, protect human health and the environment, and comply with ARARs.

N. DOCUMENTATION OF SIGNIFICANT CHANGES

The Selected Remedy is essentially the same as Alternative 5 which was the preferred alternative of EPA and UDEQ as presented to the public. As a result of the public comment, an additional element was added to Alternative 5 in the Selected Remedy. The additional element was EPA's and UDEQ's response to a potential problem of water level drawdowns in the aquifer as a result of aggressive pumping from the acid plume. The change requires private or municipal well owners who discover their wells have been rendered useless because of water level declines as a result of this project should be consulted and provided with options to solve their problem by the PRP. This would be done on a case-by-case basis. Solutions would be dependent on the nature of the well, its uses, and the cost of alternatives. The plan will be included as a work element in the RD/RA Consent Decree.

PART 3: RESPONSIVENESS SUMMARY

A public comment period was held on the joint Natural Resources Damage Settlement Plan (administered under a Consent Decree entered in Federal Court by the State of Utah, Kennecott Utah Copper Corporation and the Jordan Valley Water Conservancy District) and the Proposed Plan for the CERCLA action. The Public Meeting also covered both plans. This Responsiveness Summary (an attachment to the EPA Record of Decision) deals solely with those issues and concerns raised by the interested parties concerning only the CERCLA portion of the action. The comments regarding the Natural Resources Damage Settlement Plan will be submitted separately to the Utah Natural Resources Trustee.

Please note that some of the comments have been edited. The full version of the comments is available in the Administrative Record.

- I. E-mail from Glenn and Melody Rowe
2427 Temple View Lane
South Jordan, UT 84095

1. Comment: We agree with the need to clean up the plume.

Answer: EPA and UDEQ concur with this comment. If the plume is not cleaned up, contaminated ground water will continue to move downgradient toward the Jordan River continuing to contaminate additional areas. More wells will be impacted and the aquatic life in the Jordan River might also be affected by the additional load of contamination.

2. Comment: We wonder what other hazards are there about which we are not being given complete information.

Answer: EPA and UDEQ in conjunction with Kennecott established a systematic approach to identifying and correcting all the significant environmental problems produced by mining activities in the Oquirrh Mountains since the 1860s. Kennecott agreed to evaluate historic sites on their property and UDEQ took the lead in investigating potential off-site problems. During UDEQ's investigations, every watershed coming down the east side of the Oquirrh was studied and areas of airborne deposition were evaluated as well. A few additional problems were found and the agencies launched a cleanup program for those. Kennecott has nearly completed their investigations of historic (and current) facilities. The list of sites was compiled from books and articles written during various time periods, interviews with former employees, historic photographs, diaries, and newspaper accounts. Each site was located, and sampled for wastes remaining on the property. If the wastes could wash downstream, or if the wastes could leach materials to the ground water, the wastes were removed and placed into repositories. Several pockets of contamination were found and cleaned up in this project. EPA and UDEQ are now confident that we are unlikely to find any further surprises due to mining activities in the

Oquirrhos. If, however, additional contamination is discovered in the future, EPA and UDEQ still have the authority to address it appropriately. The information gathered during this project is available for public viewing at the offices of UDEQ, 168 N 1950 W, Salt Lake City.

3. Comment: We also wonder about the comment that the water does not damage plants. Some shade trees watered with our well water have died.

Answer: Thank you for the information. EPA and UDEQ were also concerned about the impact of elevated sulfates on irrigation water because many of the water wells in this area are used for irrigation. Two studies concerning use of these waters for irrigation were conducted. The first study was conducted by Utah State University in which examples of different classes of plants were grown in a greenhouse and irrigated with waters from the Kennecott site. They found that increasing amounts of sulfate up to 1700 ppm sulfate did not impact fescue, alfalfa, or broccoli. The highest sulfate level did reduce bean growth but bean yield was unimpacted. This study was conducted through one growing season.

Kennecott conducted a follow up outdoors study on the former footprint of the South Jordan Evaporation Ponds. They used different waters to irrigate different plants commonly found in a suburban setting. Plants included sod, shrubs, perennial and annual flowers, vegetables such as tomatoes and corn, and a few trees. This study was conducted over a three year period. Waters tested included 4 different waters from different wells and tunnels plus water from South Jordan culinary system. In response to this concern, Kennecott investigators have gone back to the original field notes and data regarding the trees in their study. Kennecott's experiment included shrubs, conifers, and fruit trees. No shade trees were included. There were a few trees that did not survive the first winter. This was attributed to normal kills associated with use of nursery stock.

According to Kennecott, the well in question was identified by Kennecott in the well inventory study as SJG1684. Water quality sampling revealed that the sulfate concentration in 1994 was 450 mg/L and the chloride concentration was 237 mg/L. The water also had 114 mg/L sodium, a constituent to which many plants are sensitive. The chloride and sodium concentrations are high relative to contamination attributable to Kennecott, but at least a portion of the sulfate is attributable to Kennecott. The health of the trees may not have been due to the increased sulfate from Kennecott sources, but rather due to the elevated chloride and sodium present in the water.

II Letter from Mike R. Barela
13320 S 7565 W
Herriman, UT 84065

4. Comment: Real estate values will drop if homes in the affected area are not provided an alternative source of water.

Answer: Adequate drinking water supplies are a vital element in planning for development in growing communities. Retrofitting gets complicated especially when competing interests are involved. Customers get caught in the middle. When the situation is caused by contamination from nearby industrial sources, EPA and UDEQ have authority to act. Otherwise, this is a local problem.

5. Comment: If water is provided for one area it should be provided to all areas affected. Funds set aside by Kennecott should be used to (restore, replace, or acquire the equivalent) to both zones A and B.

Answer: Funding to provide alternative water was a part of the NRD settlement. The CERCLA action is not primarily concerned with the provision of treated water to the public within the affected area. The decision on allocation of any treated water is up to the State Trustee. Under the current proposal to the Trustee submitted by JWCD and Kennecott, division of the water is based on the area of affected ground water within the boundaries of each system, the population served, and the water rights held by each entity.

6. Comment: What is being done to protect the citizens in Herriman from contaminated water?

Answer: Under provisions of a State of Utah Ground Water Protection Permit, Kennecott was required to install a leachate collection system to trap any waters coming from their dumps. This should prevent contamination in the future.

7. Comment: How do we make sure that new drilling or increased pumping for water supplies which go to other areas does not affect wells in Herriman?

Answer: The ground water model developed by USGS and Kennecott suggests that pumping of the acid waters from the plume associated with Bingham Canyon will drop water levels as far away as Herriman. EPA, UDEQ, Kennecott and JWCD all agree that the model is simply a prediction tool that is only as good as our current knowledge of the ground water in the area. For this reason, all advocate a continuing monitoring program which will study both the water levels in the wells of this area and the water quality of those wells. This information can be used to refine the calculations and model and give an early warning if water levels are affected due to pumping in this project. Corrective action may be necessary either to replace water or deepen the impacted wells should this occur.

8. Comment: If wells in Herriman are affected, when would replacement water become available?

Answer: If water levels begin to drop because of pumping of the acid plume, it will be a gradual decline and sufficient time will be available for planning and construction of the needed infrastructure.

9. Comment: Would wells in Herriman be monitored for contamination on a regular basis?

Answer: Continued monitoring of the wells in the affected areas will be a part of this project. The monitoring program can be used to determine if the ground water levels are being influenced by the withdrawal of the acid plume and check to see if ground water quality is improving or degrading as a result of this effort. Also public water supplies are monitored on a regular basis as required by the State Drinking Water Program.

10. Comment: What are the long term health effects for this type of contamination?

Answer: The health impacts of sulfates in drinking water are largely acute rather than chronic. Sulfates in high concentrations cause diarrhea. It is even used in over the counter laxative medicines. The impacts are short lived and there is evidence that people get acclimated to elevated sulfates in their water within a week and the effects disappear. Even these short term impacts can have serious consequences for infants where the diarrhea can cause rapid dehydration. The only long term impact even theoretically linked to sulfates in drinking water is formation of kidney stones. Kidney stones are thought to be related to calcium content of the urine and some investigators have linked sulfate ingestion with calcium in the urine, hence the theory that sulfate may be involved. This is disputed by other investigators who found no relationship between sulfate ingestion and kidney stone formation.

III Letter from Herriman Residents for Responsible Reclamation.
Richard Dansie, President
6120 W. 13100 S.
Herriman, UT 84065

11. Comment: The members of HRRR are concerned about the drawdown and the impact on surrounding municipal and privately held wells and water resources.

Answer: Drawdowns may occur associated with accelerated pumping of the acid plume. A provision in the selected remedy was added to deal with this potential problem.

12. Comment: Should substantial losses occur due to drawdown of the water table, the plan should include options to be implemented. These could include restoration,

replacement or acquisition of waters for municipalities and private well owners. The replacement options should be identified now, and the drawdown should be monitored.

Answer: The computer model predicts that there will be drawdown from the acid plume remediation. As the pumping is occurring, wells in the Herriman area will be monitored for water level and quality. If the monitoring program reveals evidence of draw down in the Herriman area attributable to acid plume remediation, several options are available to compensate the water users in Herriman. These include: (1) hook up to municipal water, paid for by Kennecott; (2) installation and maintenance of a residential reverse osmosis treatment system if municipal water hook-up is impractical; (3) deepening of the affected well if it is thought that a deeper well would yield sufficient replacement water; (4) replacement of water using Kennecott sources, or (5) underground injection upgradient of affected wells to counterbalance the drawdown. A provision in the selected remedy was added to deal with this potential problem.

IV Letter from Marcelle Shoop
Kennecott Utah Copper Corporation
P.O. Box 6001
Magna, UT 84044

13. Comment: Kennecott requests that the ROD include a brief explanation in a footnote or parenthetical clarifying the use of the name "Kennecott". The company now known as Kennecott Utah Copper Corporation has operated in the past under several names and has been owned by different holding companies. Other companies with Kennecott in the title are not involved with Bingham Canyon operations.

Answer: EPA is not opposed to including a clarification concerning the name "Kennecott" when referring to historic entities conducting activities relative to the site. A chronology of companies using the name "Kennecott" was provided by Kennecott Utah Copper Corporation and is included in the administrative record for this action.

14. Comment: Kennecott requests that Zone B treatment facilities not be a part of the ROD, but rather solely part of the NRD settlement. Zone A should only be addressed by the ROD. CERCLA authority in Zone A is clear and uncontested; whereas, CERCLA authority in Zone B is controversial. The use of the NRD settlement for Zone B takes care of this situation.

Answer: While EPA remains concerned about both the Zone A and Zone B plumes, it believes that the combination of CERCLA and State Natural Resources Damages Consent Decree authorities adequately ensures that both plumes will be addressed. EPA's ROD will address only the Zone A plume, with the expressed expectation that the

State's Consent Decree will address the Zone B plume. EPA does not necessarily agree with Kennecott's interpretation of whether CERCLA can reach the Zone B plume, and reserves its rights to assert contrary arguments or to address the Zone B plume at a later date, if warranted.

V Letter and Fax from Roger Payne,
City of West Jordan
8030 S 4000 W
West Jordan, UT 84088

15. Comment: The City of West Jordan understands the need to clean up this valuable resource, and to correct the problems with the ground water supply.

Answer: Thank you for your support. The City has been an active participant in the Technical Review Committee for the project, both in expressing concerns throughout the study phase and in evaluating the various alternatives.

16. Comment: The City suggests delivery of the Zone A water to a proposed city reservoir at elevation 5335 feet rather than the District's existing reservoir at elevation 5148 feet. This would allow the city to service growing western suburbs without pumping.

Answer: JWCD has indicated to EPA that it has met with West Jordan City to discuss this proposal to co-locate a pump station at the Zone A plant for delivering the City's allocation of Zone A treated water to a slightly higher elevation. JWCD will cooperate with the City to accomplish this objective.

17. Comment: The City is concerned about maintaining the existing municipal well field located just north of the current boundary of the contaminated plume. The City would like to investigate additional measures to protect this well field such as a ground water recharge program.

Answer: EPA and UDEQ are also concerned about protecting this well field. We have included in the selected remedy an option to include reinjection of water as an additional protective measure should this become necessary in the future. Appropriate ground water modeling would need to be performed and permits would need to be obtained. The alternative to store water in the winter months in above-ground tanks instead of injection may also be considered.

VI Letter from Dansie Water Company,
Rodney, Richard, and Boyd Dansie
7198 West 13090 South
Herriman, UT 84065

18. Comment: The water in Dansie culinary wells has been degraded by Kennecott operations.

Answer: Unlike the contaminated ground water plumes down gradient of the Bingham Canyon operations and the Lark mines where the mining related sources are clear and obvious, the sources of the high TDS in the ground water in the Butterfield Creek area are not as certain. This is because the ground water in the Butterfield Creek area is also characterized by elevated chlorides in addition to sulfates. Waters from Kennecott's leaching operations are characterized by elevated sulfates but are rather poor in chloride. Therefore, it is possible that the high TDS of groundwater in the Butterfield Creek area may be influenced by other sources which may not be mining related at all. It would take substantial studies and investigations to determine the exact causes of the high TDS and chloride which may be caused by the leaching of soluble components from the volcanic rock of the area. Contamination from Kennecott sources is only one of several possibilities. One study suggests that the elevated chlorides come from hydrothermal activity or brines left from the formation of the ore body. In this situation, chlorides and other components are a natural component of the ground water. For more details on this, see discussion of Herriman wells in the Shepherd-Miller report, Appendix B of the Remedial Investigation report.

Another way to determine if Kennecott operations are in fact responsible for contamination is by examination of historical water quality information - comparison of today's water quality with water quality prior to Kennecott dumping. EPA does not require industries to clean up waters cleaner than background concentrations.

CERCLA has authority to take action when there is a risk to human health (or a potential risk to human health. Although the Dansie water may be high in TDS, there is no evidence that any health based standard has been violated recently.

Please also note that EPA does not take a position with respect to any claims that the Dansies, or any other party, may have with respect to Kennecott or other potentially responsible parties, as defined by CERCLA, at this or other Superfund sites. The ROD speaks to EPA's preferred remedy for addressing the contamination at the Kennecott South Zone site. It does not address the liability of any parties associated with the site.

19. Comment: If the Dansie property is included in the site, where does the Dansie Water Company get its replacement water?

Answer: This question should be negotiated between the Dansie Water Company, Kennecott, the Jordan Valley Water Conservancy District, and perhaps the town of Herriman. The site is defined as ground water which has been affected by mining activities. At this time, it is not certain that the Dansie wells have been affected by mining, or that the water from the Dansie wells pose a health risk above background.

20. Comment: Dansie Water Company is concerned about the effect of draw down on its wells and surface water supplies.

Answer: The ground water model developed by USGS and Kennecott suggests that pumping of the acid waters from the plume associated with Bingham Canyon will lower water levels as far away as Herriman. Surface water supply (Butterfield Creek) is not affected in this model. The model is simply a prediction tool that is only as good as our current knowledge of the ground water in the area; therefore, a continuing monitoring program which will monitor water levels and water quality of the Dansie Water Company wells and other area wells will be implemented. Cooperation with private well owners is vital to the success of this monitoring program. Monitoring information can then be used to refine the calculations and model and give an early warning if water levels are affected by pumping in this project and/or pumping by other parties. Corrective action may be necessary either to replace water or deepen the impacted wells should this occur. Development of a plan to deal with potential drawdowns on municipal and private wells has been included as a part of the selected remedy.

21. Comment: It would be better to use Utah Lake water rather than water from the Bingham area plume. It would take less treatment and produce no drawdowns.

Answer: Although this suggestion would have great merit if this were strictly a water supply project, the main goal of the project is to withdraw the acid plume and keep it from moving downgradient polluting more of the aquifer as it travels. For CERCLA, the use of the water following withdrawal is only a secondary concern. The NRD settlement was negotiated in part to provide that the water withdrawn from the affected area is put to beneficial use for the municipalities. While importing Utah Lake water for treatment and use would be an additional source of water for the area, this would do nothing to contain or remove the contamination from the Bingham Canyon plume, the major goal of this action.

22. Comment: Dansie Water Company opposes the proposed moratorium on new wells and increases in pumping rates because of the pollution caused by Kennecott.

Answer: There is already a moratorium on drilling of new wells and increases in pumping rates that was imposed by the State Engineer in 1991 in Salt Lake Valley.

As stated by the Division of Water Rights, Kennecott has neither filed nor received approval for a moratorium on any ground water development in the area. In 1991 the State Engineer implemented the Interim Ground Water Management Plan for Salt Lake Valley which closed the entire valley to applications to appropriate ground water. The State Engineer is currently in the process of developing a long term management plan for the Valley. It is proposed that before new wells are drilled in the affected area the

impact on the water quality be considered and Kennecott be given an opportunity to assist the water user in meeting their water requirements while at the same time insuring that the diversion of water does not adversely affect the cleanup efforts. The State Engineer is very aware of the property rights issues involved and is not attempting to limit or adversely impact these rights.

23. Comment: Kennecott should be required to replace the water that they contaminated. They should not only pay the cost of the connections but also the cost of the water as well.

Answer: The ROD deals only with selection of a remedy to clean up the contamination. It does not address liability or damages to private parties. The NRD Settlement does deal with damages to the natural resources of the state.

24. Comment: The proposal should be rejected and more studies conducted. The assumptions for the modeling should be given. Studies should include extra modeling of the drawdowns conducted by an outside consultant.

Answer: The studies of the plume have been going on since at least 1983 and under EPA oversight since 1992. The model used by Kennecott in their projections of water level drops and plume movement was originally developed by the U. S. Geological Survey (USGS). Kennecott augmented the USGS model by providing a finer grid and additional monitoring data. To test the model's ability to predict the future, Kennecott conducted several runs of the model beginning in 1965 when the reservoir was first installed, continuing to the present. Some assumptions were modified in order to produce the best fit. The model was also evaluated by sensitivity testing to determine which assumptions were most critical to the performance of the model. The work of Kennecott was overseen by modeling experts from EPA, by the USGS (under the funding of an Interagency Agreement with EPA) and by the UDEQ Ground Water Protection Program. The lead for the oversight was the person who actually developed the USGS model for the Salt Lake Valley. EPA and UDEQ are satisfied that the model is adequate for decision making and initial designs. The model uses established USGS and EPA methodology and is used by hydrogeologic professionals worldwide. Of course, monitoring is a part of the remedy to insure that there is adequate warning should the plume move in unsuspected directions, or if draw downs are more serious than first thought.

25. Comment: Negotiations between Kennecott and Dansie Water Company are an example of how Kennecott might handle other water rights owners.

Answer: The Dansie Water Company has unique problems in comparison with most water rights owners. The primary difference is that the high TDS content present in wells operated by the Dansie Water Company may not, in fact, be related to mining contamination. The chemical content in the Dansie wells is not similar to the chemical

content of other impacted wells in the valley. Another problem is that plans to bring replacement water to the area are complicated by a legal action involving the Dansie Water Company and its neighbors. Finally, the Dansie Water Company has tried to couple their well issues with Kennecott into other areas of dispute with Kennecott. These other issues are much more difficult than even the water issues by themselves. Other well owners are not encumbered by such complications. The ROD selects a remedy for the aquifer. It does not resolve private claims allow by law.

26. Comment: Kennecott should be declared a Superfund site. It will be hard to get to Rio Tinto after Kennecott is no longer around.

Answer: An agreement, called a Memorandum of Understanding, was reached in 1995 between Kennecott, EPA and UDEQ in which the agencies agreed not to proceed with listing of Kennecott on the National Priority List (NPL) so long as Kennecott performed specific cleanups and studies in the agreement. Kennecott has continued to make progress towards compliance with each of these provisions. The agreement was done as an enforcement pilot by EPA to see if cooperative companies could clean up sites without the stigma of listing on the NPL. The pilot has been viewed as a success.

Listing on the NPL has only one advantage. It is a requirement before the site is eligible to use federal funding for Remedial Actions. (Remedial Actions are typically much larger and more complex than Removal Actions). Since Kennecott indicated that it will fund the ground water cleanup without the use of taxpayer dollars, listing is superfluous in this case. However, if circumstances change and listing becomes necessary to implement his remedy, EPA will reconsider that option.

Listing on the NPL has no relation to liability questions. A party may be liable for cleanups with or without listing. In this case, the provisions of what cleanups must be done and what Kennecott must pay for will be detailed in a Consent Decree which will be supervised by the Federal Court in Utah. These requirements will need to be met whether or not Kennecott is still operating. The Record of Decision merely establishes the technical basis for the cleanup decision and provides the general approach to be used. It does not establish schedules or the actual design. Those details are typically given in the work plan associated with the later Consent Decree. Listing on the NPL has no effect on either the Record of Decision or the Consent Decree.

VII Letter from Rodney Dansie
7198 West 13090 South
Herriman, UT 84065

27. Comment: The plan does not put water back to the affected area where surface and ground water have been injured.

Answer: Note - this is apparently a NRD Consent Decree provision. CERCLA itself does not require that the water be "put back" to the affected area.

28. Comment: Water quality has degraded in the Herriman area and this area has not been included on the maps of affected areas. It should either be included in the site, or designated as a separate site.

Answer: For CERCLA purposes, the Herriman area does appear on the map of the "site" in the Remedial Investigation Report. In the NRD Consent Decree, the "affected area" is defined as "the area in the southwestern portion of Salt Lake Valley where surface and ground water have been injured by Kennecott's mining and leaching operations." See also previous response to #19.

29. Comment: The plan has not provided for replacement of water in the area west of Herriman where the water had been degraded.

Answer: For logistical reasons, the JFWCD has agreed to provide service connections to central locations. The nearest location in this case would be in Herriman. Citizens can negotiate with the town of Herriman to be included in their system when it is implemented. Private connections are also possible through negotiations with the JFWCD.

30. Comment: The plan does not include provisions to replace and restore water in the area west of Herriman. The plan should also pay for damages to the water companies and water rights owners.

Answer: The purpose of the ROD is the selection of a remedy which will be used to clean up the acid plume where the ground water presents a risk to human health and the environment. The ground water west of Herriman does not present a risk at yet. The remedy addresses the Herriman area by prevention of leachate from entering the ground water, and continuing to monitor the situation so that action may be taken should the water quality degrade beyond background and begin to present a health risk. High TDS does not pose a health risk in and of itself.

The ROD does not determine liability of any party. CERCLA has no provisions to settle private damage claims caused by pollution. The replacement and restoration of natural resources, such as water, are addressed in the Natural Resources Damage provisions of CERCLA. The NRD Claim provisions provide that states, tribes, and the federal government are the only groups which can bring claims for natural resources damages.

31. Comment: Water rights should be protected from unlawful taking. The plan does not correct the problems of water degradation in the area west of Herriman. Replacement water should be provided and damages paid to water rights owners.

Answer: The selected remedy does call for replacement of water supplies should the drinking water be impacted by mining activities and pose a risk to customers. It does not have authority to settle private claims for pollution damage.

32. Comment: The proposed plan has no provisions to deal with contamination in the area west of Herriman. It should be included in the plan or separate one developed for this situation. The area should receive treated water and be paid for damages.

Answer: At this time, water quality west of Herriman has not degraded to the point where it presents a health threat to users. CERCLA does not deal with damages to private parties due to pollution. This is handled privately between the parties involved.

33. Comment: No replacement water has been provided for Dansie Water Rights. Pollution may be continuing.

Answer: Efforts have been made under the provision of a Utah Ground Water Protection Permit to prevent further contamination. Replacement water is a provision of the remedy should the well water pose a health risk.

34. Comment: A plan on how to address the Dansie's damages should be developed and implemented before the Record of Decision is made. The should include an estimate of when damages will be paid and when replacement water will be provided.

Answer: The ROD does not address liability issues. Any negotiations regarding damages have to occur between the parties involved. EPA's authority, under CERCLA, does not allow EPA to interfere in these matters.

35. Comment: What is the effect of the pump and treat of the acid plume on the dropping of water levels in Herriman wells?

Answer: The amount of water level drops due to pumping of the acid plume will be a function of the amount of water pumped. If water levels drop as a function of the pumping, the effect will be most serious in the area of the acid plume gradually tapering off toward the edge of the valley. Water level drops are a function of the pumping rates in the entire area, including the pumping of the plume. Should water level drops be noticed as a function of pumping in this project, the decline will be gradual and there should be sufficient time to plan remedies for the private well owners. Each situation will be handled on a case-by-case basis.

36. Comment: The model which predicts water elevation drops was prepared by Kennecott and the District. Their studies should be reviewed by an outside consultant.

Answer: See previous answer to #24. The model used has also been reviewed by the governmental entities involved including EPA, USGS, and UDEQ.

37. Comment: Additional studies of the water level model and assumptions should be conducted. A model is only as good as the assumptions used.

Answer: EPA and UDEQ agree that the ability of any model to predict the future is a function of the assumptions used in it. For this reason, EPA and UDEQ will require that a monitoring program be designed to refine assumptions for the ground water model and to determine if the plume and drawdowns are behaving in reality as predicted by the model. In addition, Kennecott and USGS have launched a new effort to better understand water flow within the Oquirrh Mountains. This study might give better information on flows within the bedrock aquifer and where the bedrock aquifer recharges the alluvial aquifers in the Salt Lake and Tooele Valleys. The model is useful as a way to compare performance of alternatives relative to each other. But monitoring is required to determine if the plume is behaving as predicted. Additional modeling efforts may be needed if the plume is behaving differently than the original model predicted.

38. Comment: Kennecott proposes to use the clean water of the valley in their treatment of water they contaminated. This impacts the other water rights owners in the valley. Kennecott should import water to clean up the plumes, rather than using water owned by others.

Answer: The agencies do not understand what is being referred to in this comment. No clean water is being used in the treatment processes for either Zone A or Zone B. This comment may refer to the area-wide drawdowns that may occur during the process of pumping the acid plume from the aquifer. Drawdowns are a consequence of trying to remove as much of the acid plume in as short a time frame as possible. It is also an effective way of providing a barrier to prevent further downgradient movement of the plume. Kennecott has all the early water rights they need without using those of others. Please note that the ground water is actually owned by the State of Utah. Individuals get permission to develop the water under certain conditions as outlined by Utah Water Law and the State Engineer.

39. Comment: Other alternatives should be examined which do not rely on water from the Herriman area or affect water levels in the Herriman area.

Answer: Water withdrawals are a necessary element to begin restoration of the aquifer at this site. The size of the plume is so large and so deep that in-situ schemes would be very costly and might not work at all. Drawdowns are an unpleasant consequence of water withdrawals, but the impacts to other water users from these drawdowns can be minimized or mitigated and these methods will be mentioned specifically in the Record of Decision and the CERCLA consent decree.

40. Comment: Thank you for your efforts. Please require that additional work be performed to address concerns.

Answer: The major scientific question which remains unresolved at this juncture is whether the elevated TDS levels in the Dansie wells are natural or related to mining activities. If a settlement between the parties occurs, this issue becomes moot. If a settlement is not reached, the source of the elevated TDS becomes important in determining if this well is included in the CERCLA action. CERCLA does not require cleanups of any naturally occurring substances or when contaminants do not pose a threat or potential threat to human health or the environment.

VIII Letter from Steve Maxfield
91 Canyon Rd
Herriman, UT 84065

41. Comment: I would like to know about the impacts of the cleanup plan on my well.
(A culinary well in Hi-Country Estates, Phase 1)

Answer: The water level drops which might occur because of pumping of the acid plume are most likely to be felt near the acid plume and less so towards the edges of the valley. Wells installed in other aquifers are unlikely to be impacted.

42. Comment: I am concerned that continuing natural and leaching activities to the west will affect the quality of the water in my well.

Answer: The leach waters emanating from the mining area are now being controlled with cutoff walls in the Butterfield Canyon gulches under the provisions of a Utah Ground Water Protection permit. Natural leaching, although it can cause poor water quality, falls outside the authority of CERCLA.

43. Comment: EPA should protect water rights owners in this area from contamination and drawdown of water tables.

Answer: EPA and UDEQ are concerned when private wells are impacted from industrial sources. Drawdowns due to over pumping are generally in the purview of the State Engineer's office. In this project, a separate provision has been added to deal with drawdowns resulting from this project.

44. Comment: Other water should be imported for the cleanup water processing rather than mining the water in the area.

Answer: See previous answer to #21.

45. Comment: The mining company should not be able to take remaining water to clean up the contamination that they created.

Answer: As far as is known about this project, no clean water is being used in the cleanup.

IX Phone message from Vickie Walker
7536 W 13323 South
Herriman, UT 84065

46. Comment: I am concerned about the drawdown within the aquifer.

Answer: The ground water model developed by USGS and Kennecott suggests that pumping of the acid waters from the plume associated with Bingham Canyon will drop water levels as far away as Herriman and possibly to 1300 W and 10600 S. The model is simply a prediction tool that is only as good as our current knowledge of the ground water in the area; therefore, a continuing monitoring program which will monitor water levels and water quality in the area will be implemented. Cooperation with private well owners is vital to the success of this monitoring program. Monitoring information can then be used to refine the calculations and model and give an early warning if water levels are affected by pumping in this project and/or pumping by other parties. A separate provision in the remedy has been added to deal with draw downs should they occur as a part of this project.

47. Comment: What will be the compensation plan if her well is affected?

Answer: Corrective action may include substitution with water from another source such as municipal water or Kennecott sources, deepening of the impacted well, or treatment of private well water using a residential reverse osmosis treatment system.

48. Comment: I would like to be hooked up to city water.

Answer: If a private well is found to be impacted by acid plume remediation, the compensation will be worked out by the parties involved.

X Phone message from Bob Bowles, property owner in Herriman

49. Comment: I am concerned about the drawdown in the aquifer and how that might affect my four irrigation wells south of Herriman.

Answer: The ground water model developed by USGS and Kennecott suggests that pumping of the acid waters from the plume associated with Bingham Canyon will drop water levels as far away as Herriman. The model is simply a prediction tool that is only as good as our current knowledge of the ground water in the area; therefore, a continuing monitoring program which will monitor water levels and water quality in the area will be implemented. Cooperation with private well owners is vital to the success of this monitoring program. Monitoring information can then be used to refine the calculations and model and give an early warning if water levels are affected by pumping in this project and/or pumping by others. A separate provision in the remedy has been added to deal with drawdowns should they occur as a part of this project.

50. Comment: What compensation will I get if my wells become useless (go dry). This should be put in writing.

Answer: Corrective action may include substitution with water from another source such as municipal water or Kennecott sources, deepening of the impacted wells, or treatment of private well water using a residential reverse osmosis treatment system. The concept of addressing impacts due to drawdowns is included in the Record of Decision. Each water well owner will be dealt with separately for the solution most appropriate to the situation.

- XI Phone message from Eileen Brooks
12680 South 3600 West
Riverton, UT 84065

51. Comment: What compensation will Kennecott provide if contamination increases in my well water? Can I get my well tested?

Answer: The well in question is owned by Ms. Brooks' mother, Elma Johnson and is located at 12872 S 3600 W. It is identified as HMG1548 by Kennecott and was sampled as part of the well inventory project in 1994. The results of this project showed no evidence of mining impacts (68 mg/L sulfate) and that well is south of known contamination and any known contamination sources. Given its location away from the contamination, it is not likely the well would need to be resampled, but it is possible that water level information would be collected. It is also outside the area of predicted draw down associated with acid plume pumping.

- XII Public Hearing Testimony: Betty Naylor - none of comments regarded the CERCLA portion of the action. Ms. Naylor's questions were referred to UDEQ for response as a part of the NRD settlement proposal.

XIII Public Hearing Testimony: Steve Hansknecht

52. Comment: Kennecott used their water rights in Butterfield Canyon at the expense of the downstream farmers and the court made a mistake to let them do it.

Answer: There were several lawsuits involving water rights in Butterfield Canyon in which the farmers in Herriman claimed that the mining companies had interfered with their water rights. Most of these lawsuits predated Kennecott's ownership of the land and the water rights. There were continuing disputes after Kennecott gained the water rights, but these were usually settled. For example, Kennecott did give the Herriman Irrigation Company water from the Bingham Tunnel so long as it was not needed in their processing. Kennecott later indicated that the water was needed in processing and the water to the irrigation company was cut off. The water was contaminated by arsenic and the state objected to its use for irrigation also. EPA and UDEQ concur with the citizen that the continual fights between the farmers and the miners in this area were unpleasant.

53. Comment: It is better to let Kennecott get the copper out of the water, then treat it for people to use than to let it go to the Jordan River. I'm glad somebody finally is doing something about it.

Answer: EPA and UDEQ concur.

XIV Public Hearing Testimony: Rod Dansie

54. Comment: The plan is a good one to try to clean the water up. I am concerned about the Herriman area water.

Answer: The main effect of this project in Herriman is a potential drop in water levels. Although the model gives an idea of how severe it might be, the situation will need continual monitoring as the project proceeds.

55. Comment: I'm not convinced that the model will do what they say. Kennecott thinks the water will come up from the bedrock. I'm not convinced it will.

Answer: The model is only a projection of what might happen based on what we know now. Continual monitoring will be needed as the project proceeds to determine what the recharge is and where.

56. Comment: The agencies should bring in water from Utah Lake or the Jordan River, not to West Jordan, but to Herriman. We need to get water back to the area where draw downs will occur.

Answer: This is a NRD question. CERCLA doesn't require that water be returned to the impacted area.

57. Comment: Maybe the water can be cleaned used in the taps, then let it go back into the ground. This is better than cleaning up the water only to reinject it into the aquifer without using it first.

Answer: The idea of reinjection of the water back into the aquifer was controversial. Those concerned with water supply indicated that this was a waste of a valuable resource. Several scientists questioned whether it was a good idea to clean up the water and reinject it only to have the same water be contaminated again. Modeling suggested that cleanup time frames would not be shortened by this strategy. The only potential use would be as a method to protect nearby municipal well fields.

58. Comment: In the past, the state engineer rejected change applications on the basis that the water was being taken from one aquifer and used in another, recharging that aquifer instead of the one from which the water was originally taken. Does this plan do the same thing?

Answer: This is possible. According to the Division of Water Rights, in the evaluation of change applications, the State Engineer's management plan does not allow changes from the shallow ground water aquifer to the deeper principal aquifer. Also, a change application which proposes to transfer a water right to a different area is critically reviewed. The proposed project will require water right applications and they will be evaluated by the State Engineer according to Utah Water Law statutes and using the guidelines set forth in the ground water management plan. Kennecott indicates that it owns water rights in both the principal aquifer and the bedrock aquifers in the Oquirrh Mountains. JVVCD owns rights in both the principal and the shallow unconfined aquifers. Water rights may need to be transferred to accommodate this plan. The State Engineer has told Kennecott that he will allow transfer out of the principal aquifer to other aquifers, but not vice versa.

59. Comment: Something should be built into the plan so that individuals will not have to battle each time to prove interference. Individuals know how their wells behave, but it is hard to prove interference.

Answer: For most circumstances, interference will be rather simple to prove because water levels in nearby wells will be similarly impacted. There will be area-wide impacts on water levels. No special mechanism or criteria is needed. See also previous response.

60. Comment: Kennecott dumped major amounts of sulphuric acid on the dumps 20 or 30 years ago. Some leaching occurred south towards Butterfield Canyon, but not a lot.

Answer: Kennecott and previous operators in the area were heavily engaged in leaching of the waste rock dumps. The record is clear on that point, and Kennecott has not denied this. Today ground water and surface water in Butterfield Canyon are monitored as required by a Utah Ground Water Discharge Permit. The results indicate that a few of the wells show elevated sulfate and some of the meteoric leach water draining from the dumps is slightly acidic. These impacts are most likely a result of meteoric leaching of the South Mine Waste Rock Dumps which were not infused with sulphuric acid. Ground water monitoring and an independent study conducted by the University of Utah indicates that the path of ground water from the dumps that were infused with acid is directly east, not south to the Herriman area.

61. Comment: It is great that this project will bring water to Herriman, but Herriman Town does not own water rights, the private well owners and companies do. The water is not going to the water rights owners who have been impacted.

Answer: The division of the water is a part of the NRD settlement. That is a matter for negotiations between the municipalities, the JWCD and the State Trustee. According to the JWCD, the proposed plan submitted to the State Trustee will use municipal and industrial water rights in the affected area to provide treated water to the public in the affected area. The only M&I ground water rights currently in the affected area belong to JWCD, Kennecott, Riverton City and West Jordan City. However, the entire public in the affected area will benefit under the proposed project, not just a few private water right holders.

62. Comment: Our water rights are significant and we worked on them for 50 years to bring water to our properties.

Answer: Utah water law is based on the prior appropriation doctrine, which is first in time, first in right. In any action by the State Engineer a fundamental part of his review is to insure that they do not affect prior water rights without just compensation.

63. Comment: It will be hard to establish responsibility on a case-by-case basis and some plan for arbitration should be included so that legal fees are not incurred.

Answer: Responsibility in most situations will be obvious and clear-cut. Degradation due to mining is typically indicated by rising sulfate levels and water levels will be affected over a wide area. Arbitration is not needed for most of these situations. The Dansie case is a fairly unique situation. If disputes arise in the future, any party has the right to suggest the use of alternative dispute resolution procedures to resolve such disputes. See also previous response.

64. Comment: Water should not come back to a community [Herriman Town] that has no water rights, and there is no guarantee that the water won't be marked up. It could be a slush fund for the city that needs taxes. This doesn't benefit the people that developed the water rights.

Answer: The decision on how the water is allocated is a matter for determination by the State Trustee. As stated by JWWCD, the cooperating water purveyor, it is assumed that the Town of Herriman will act responsibly to its residents in distributing and selling treated water from the project plants delivered to it by JWWCD on a wholesale basis. JWWCD will make other retail deliveries to its residents not served by the Town of Herriman under its normal Rules and Regulations for Retail Water Service, where it has present and future distribution facilities.

XV Public hearing testimony, Tom Bechak

65. Comment: It's a wonderful thing that's being done to control and contain the acid plume in Zone A, but my well is in an area where the water levels might drop 120 feet. I'm concerned about that.

Answer: The ground water model developed by USGS and Kennecott suggests that pumping of the acid waters from the plume associated with Bingham Canyon will indeed drop water levels in the area of Mr. Belchak's well by approximately 120 feet over a 50 year period. The model is simply a prediction tool that is only as good as our current knowledge of the ground water in the area; therefore, a continuing monitoring program which will monitor water levels and water quality in the area will be implemented. Cooperation with private well owners is vital to the success of this monitoring program. Monitoring information can then be used to refine the calculations and model and give an early warning if water levels are affected by pumping in this project and/or pumping by other parties. Corrective action may include substitution with water from another source such as municipal water or Kennecott sources. Mr. Belchak has already been drilled a new well at Kennecott's expense.

XVI Public hearing testimony, Mike Barela

66. Comment: If my well goes dry, how long will it take to get water up there?

Answer: Any area-wide drop of water levels due to water withdrawals from the acid plume will be gradual, occurring over several years. There will be sufficient time to take action before impacts become serious. Mr. Barela's well is located at 13320 S 7565 W in the Rose Canyon Area. It is just outside the model predicted area of influence, but if drawdown is more than predicted at this location, corrective action will be taken. By the time this well is affected, JWWCD will have infrastructure in the area and a connection can be made in a short period of time.

XVII Public hearing testimony, Rod Dansie

67. Comment: An additional meeting should be held in Herriman. I make a formal request for this.

Answer: Herriman residents with water rights within the site were all mailed an invitation to participate in this hearing. In addition, a newspaper advertisement invited written comments from those who chose to use this method to convey their views. Opportunities were also given to water users to meet with the scientists and engineers on a one-to-one basis. A number of residents of Herriman have participated in these ways. An additional meeting is not needed.

B. Technical Issues

Technical Issues:

Plume behavior: There are a number of uncertainties regarding plume behavior over time, despite the extensive model development and calibration. The model itself is widely used in the field (MODFLOW coupled with MT3D). It was used originally by USGS to develop the Salt Lake Valley Ground Water Model, and later refined in the RI/FS. Flow rates in the aquifer were verified by several means because historical groundwater data were available and the history of releases to groundwater were known. Even isotopic tracing techniques were used to provide independent verification. Yet, it is still a model and relies on the validity of the assumptions used in it. Although the assumptions are based on a rather large number of observations, the area affected is quite large and not every square inch of the aquifer was sampled. Undetected buried channels might provide preferential flow pathways causing the plume to move in an unanticipated direction and do so more rapidly than predicted. Hidden clay lenses could serve as a barrier thereby either diverting the plume or causing it to travel more slowly than expected. This uncertainty common to the application of all groundwater models produces an uncertainty in the absolute time it might take for remediation of the aquifer.

A further complicating factor in the case of this particular plume is the variety of chemical reactions that take place in the aquifer itself. This occurs because the acid plume reacts with the carbonates in the aquifer substrate to form a variety of metal oxides and hydroxides. It is not a matter of simply neutralizing the hydrogen ion because the majority of the acidity is "mineral acidity" largely from the high aluminum concentrations and this must be neutralized as well. Formation of these solid phase precipitates in the aquifer substrate may change the flow characteristics of the aquifer. These solid precipitates will begin to redissolve back into the groundwater when fresh water is introduced. Column testing has shown that it could take at least 7 pore volumes of water before these precipitates are redissolved and flushed away. Calculations suggest that the vast majority of the acid groundwater can be pumped out of the aquifer in 30 - 50 years, but the residuals could leach back into the water for many years after the initial plume has been removed. Although this can be modeled, the time this would take is highly uncertain and might continue for decades or longer. EPA believes that for funding and planning purposes, treatment will have to continue in perpetuity.

In addition to the uncertainty in the time frame required to clean up the plume, there is some concern with regard to the direction of plume movement under different pumping rates by the adjacent communities. Of particular concern is the well field of West Jordan located just to the north of the acid plume. The modeling did show that under some pumping scenarios the plume could be drawn in that direction. A monitoring well has been drilled between the acid plume and the West Jordan well field to provide an early warning should this occur. A similar concern was expressed with regard to wells located on the east side of the Jordan River. Could high pumping from wells in Sandy, Utah, for example, draw the contamination underneath the

river? Careful monitoring will be necessary to detect any unexpected changes and to revise time estimates.

Modeling suggests that at the maximum pumping rates needed to remove the acidic waters quickly, excessive draw downs of the water levels in the aquifer will occur locally around the acid wells and the nearby West Jordan municipal well field. Several proposals have been examined to mitigate this problem. One idea is to inject clean water between the acid plume and the West Jordan municipal well field to offset the water level drops. Modeling suggests this idea will work, but some indicate this is an inefficient use of clean water. Another possibility is that freshwater from the mountains be piped directly to West Jordan City in case their well field becomes contaminated or non-productive. This issue is still under discussion.

Treatment uncertainties: Both the reverse osmosis treatment technology and the nanofiltration technology have been tested in pilot projects. The acid plume waters cannot be treated directly using the reverse osmosis technology due to excessive scaling of the membranes. The technology performs well with the waters from less contaminated wells. Nanofiltration is proposed for pretreatment of the most contaminated waters with the permeate going to further refinement in the reverse osmosis facility. However, the operational details of the nanofiltration technology have not been optimized and this may vary as the concentrations of the plume changes. It may take 5 years of operating experience with the pretreatment plant before routine operations are feasible.

Disposal uncertainties: Pilot testing of disposal of acid waters into the tailings slurry pipeline have been ongoing for the past year. An initial problem of excessive scaling on the inside of the pipeline originally occurred resulting in a tailings overflow near the point of entry. After acid additions ceased, the tailings scoured the scale deposits out the pipeline, so no cessation of operations was necessary to clean out the pipeline. Experiments then revealed that no scale formed if the sulfate concentrations were less than 5000 ppm when added to the slurry line. Monitoring of the supernatant water in the tailings pond at the terminus of the pipeline did not reveal any increases in metals or TDS concentrations over typical concentrations with the acid additions. Laboratory experiments indicated the metals in the original acid solution had precipitated, and were not simply diluted. The supernatant water is recycled during the summer and the rest evaporates. There is no discharge. In the winter, excess water is discharged to the Great Salt Lake. Since the concentrate flows in the tailings line represent only a very small fraction of the water, no exceedances of the NPDES discharge are anticipated.

There are two difficulties with this strategy. (1) This strategy works only while the Copperton Concentrator (which grinds the ore and separates metal bearing components from the host rock by flotation) is operating. Sufficient storage capacity for the acid waters must be provided during routine shut downs for maintenance. Emergency shut downs due to power failures or labor troubles must also be considered. (2) This strategy will also work only during the life of mining and milling operations at the site. Another method of disposal will be needed upon mine closure. There are several possible alternatives here, some of which might be integrated

with other waste water disposal needs following closure. Provisions should be included in the Mine Closure Plan.

One of the proposals for disposal after mining ceases in 30 years is direct disposal of the treatment concentrates into the Great Salt Lake. Although technically feasible, there are numerous policy issues which need to be examined before this can be considered. For example, today there are no numerical water quality standards for any constituent in the Great Salt Lake. Therefore, the potential impacts cannot be judged. In the next 30 years, it is hoped that more will be known about the ecology of the Great Salt Lake and the impacts of pollutants on that ecology.

APPENDIX A

**APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
FEDERAL
(selected remedy)**

REQUIREMENT	CITATION	STATUS	DESCRIPTION	NOTES/ACTION TO ATTAIN REQUIREMENT
Safe Drinking Water Act				
National Primary Drinking Water Standards	40 C.F.R. Part 141			see state list
Maximum Contaminant Level Goals (MCLGs)	40 C.F.R. Part 141	relevant and appropriate	<i>CHEMICAL SPECIFIC</i> Maximum level of a contaminant in drinking water at which no known or anticipated adverse health effect occurs, with an adequate margin of safety.	Section 121(d)(2)(A) of CERCLA indicates that MCLGs set above zero are relevant and appropriate to set cleanup levels in ground water. All of the MCLGs for the metals of concern are the same as the MCLs set for those metals. Relevant and appropriate to ground water as a current or potential drinking water source. Compliance will be achieved through treatment and containment of sulfate greater than 1500 mg/L at edge of acid plume (point of compliance) and natural attenuation.
Secondary Drinking Water Standards	40 C.F.R. Part 143			see state list

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REQUIREMENT	CITATION	STATUS	DESCRIPTION	NOTES/ACTION TO ATTAIN REQUIREMENT
Underground Injection Control Regulations	40 C.F.R. Parts 144-147			see state list
Clean Water Act				
Water Quality Criteria	40 C.F.R. Part 131			see state list
Dredge and Fill Standards	40 C.F.R. 230	applicable	<i>LOCATION SPECIFIC</i> Regulates disposal and handling of fill and dredge materials into wetlands or waters of the United States	Applicable to activities which result in on-site dredging or filling of wetlands or waters of the U.S. None anticipated.
Clean Air Act				see state list
Resource Conservation and Recovery Act				see state list
Superfund Amendments and Reauthorization Act (SARA)				
Reportable Quantities	40 C.F.R. 302	applicable	<i>ACTION SPECIFIC</i> Reporting requirements for the release of hazardous substances above a reportable quantity	Applicable to any spills or other releases of a reportable quantity of a hazardous substance associated with the remedial action.

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<i>REQUIREMENT</i>	<i>CITATION</i>	<i>STATUS</i>	<i>DESCRIPTION</i>	<i>NOTES/ACTION TO ATTAIN REQUIREMENT</i>
Archaeological and National Historic Preservation Act	16 USC § 469, 40 C.F.R. § 6.301(g)	applicable	<i>LOCATION SPECIFIC</i> Procedures for preservation of data due to alteration of terrain	Applicable if remedial activities will disturb any archaeological or historical sites. None anticipated.
Historic Site, Buildings and Antiquities Act	16 USC § 461, 40 C.F.R. § 6.301(a)	applicable	<i>LOCATION SPECIFIC</i> Avoid undesirable impacts on historic landmarks	Applicable if remedial activities will disturb any historic landmarks. None anticipated.
Fish and Wildlife Coordination Act	16 USC § 1531-66, 40 C.F.R. § 6.302(g)	applicable	<i>LOCATION SPECIFIC</i> Requires consultation with Fish and Wildlife Service and State Wildlife Resources Agency when action will modify a body of water	Applicable if remedial activities impact wetlands or surface waters.
Floodplain Management	40 C.F.R. § 6.302(b) & Appendix A, Exec. Order No. 11,988	applicable	<i>LOCATION SPECIFIC</i> Avoid adverse impacts due to development of a floodplain	Applicable if remedial activities may impact a floodplain. None anticipated.
Protection of Wetlands	40 C.F.R. § 6.302(a) & Appendix A, Exec. Order No. 11,990	applicable	<i>LOCATION SPECIFIC</i> Avoid adversely impacting wetlands, minimize wetlands destruction and preserve the value of wetlands	Applicable if remedial actions will impact wetlands. Disposal of treatment residues to Great Salt Lake would trigger need to evaluate impact on wetlands.

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<i>REQUIREMENT</i>	<i>CITATION</i>	<i>STATUS</i>	<i>DESCRIPTION</i>	<i>NOTES/ACTION TO ATTAIN REQUIREMENT</i>
Endangered Species Act	16 USC § 1531-1543 40 C.F.R. 6.302(h)	applicable	<i>LOCATION SPECIFIC</i> Conserve endangered or threatened species and their critical habitat	Applicable if remedial actions will impact endangered species or their critical habitat. No known endangered or threatened species in area of remedial actions.

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**APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
STATE (selected remedy)**

<i>REQUIREMENT</i>	<i>CITATION</i>	<i>STATUS</i>	<i>DESCRIPTION</i>	<i>NOTES/ACTION TO ATTAIN REQUIREMENT</i>
Utah Public Drinking Water				
Water Quality Primary Maximum Contaminant Levels (MCLs)	UAC R309-103-2	applicable/ relevant and appropriate	<i>CHEMICAL SPECIFIC and ACTION SPECIFIC (municipal)</i> Establishes MCLs for drinking water supplies before delivery to public	Applicable to municipal supplies. Water quality from the treatment will achieve all MCLs before delivery to the municipal purveyors. Relevant and appropriate for culinary private wells. In-house treatment units must achieve MCLs for private well owners. May be relevant and appropriate to ground water as a current or potential drinking water source. Compliance will be achieved beyond point of compliance through treatment and containment of sulfate greater than 1500 mg/L at edge of acid plume (point of compliance) and natural attenuation.
Water Quality Secondary Standards	UAC R309-103-3	applicable	<i>CHEMICAL SPECIFIC & ACTION SPECIFIC</i> Requires public drinking water supplies to achieve certain standards	Water delivered to municipal purveyors will be treated to these standards.

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REQUIREMENT	CITATION	STATUS	DESCRIPTION	NOTES/ACTION TO ATTAIN REQUIREMENT
Public Water System Requirements; Responsibilities of Public Water System Owners & Operators, Monitoring, Reporting & Public Notification, Drinking Water Source Protections for Groundwater Sources	UAC R309-102 UAC R309-102 UAC R309-104 UAC R309-600	applicable	<i>ACTION SPECIFIC</i> Standards applicable to public drinking water systems, including design and construction standards, operation and maintenance requirements, disinfection, source development, distribution systems and source protection	Applicable if remediation includes construction of on-site municipal water treatment plant to be used to supply water to a public drinking water system.
Utah Water Quality Regulations				
Ground Water Quality Protection Regulations				

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<i>REQUIREMENT</i>	<i>CITATION</i>	<i>STATUS</i>	<i>DESCRIPTION</i>	<i>NOTES/ACTION TO ATTAIN REQUIREMENT</i>
Groundwater Quality Standards	UAC R317-6-2	applicable if more stringent than MCLs	<i>CHEMICAL SPECIFIC</i> Ground Water Quality Standards. Lists standards for protection of Groundwater quality. These standards are identical to MCLs for most contaminants listed.	The long term goal of the project is to achieve unrestricted use of the ground water. Active treatment will occur down to 1500 ppm sulfate, followed by natural attenuation which will achieve the State's primary standards.
Ground Water Corrective Action Standards.	UAC R317-6-6.15	applicable if more stringent than MCLs	<i>CHEMICAL SPECIFIC</i> Specifies corrective action concentration limits	Because other ARARs, specifically MCLs and Corrective Action Clean-up Standards under R311-211, are duplicative of the requirements of these provisions given the site-specific circumstances, application of these provisions would not result in any different remedial action or remedial action goal.
Ground Water Classes	UAC R317-6-3	applicable	<i>LOCATION SPECIFIC</i> Establishes a classification system for Groundwater in the State	The Groundwater has not yet been classified.
Ground Water Protection Levels	UAC R317-6-4	Not an ARAR	<i>ACTION SPECIFIC</i> Early warning system for uncontaminated aquifers. Section states that protection levels are not intended to be considered as applicable, relevant or appropriate clean-up standards under CERCLA	No uncontaminated Groundwater that could be impacted by remedial action.

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REQUIREMENT	CITATION	STATUS	DESCRIPTION	NOTES/ACTION TO ATTAIN REQUIREMENT
Ground Water Implementation Regulations	UAC R317-6-6	applicable	<i>ACTION SPECIFIC</i> Substantive standards for facilities which may release pollutants directly or indirectly into the subsurface waters; requirements include monitoring and use of best available technology (BAT) to minimize pollutant discharges	Applicable to any facilities constructed on-site during remedial action or used for disposal of concentrates. Other on-site facilities being used in this remedy, the tailings pond, pipeline, and concentrator already have permits.
Anti Degradation Policy	UAC R317-2-3	applicable	<i>ACTION SPECIFIC</i> Maintains and protects existing instream water uses, including protecting streams with higher water quality than the established standards	Applicable to any discharges of wastewater on-site to jurisdictional surface waters. Containment of the acid plume would prevent surface water degradation.
Mixing Zone Regulations	UAC R317-2-5	applicable	<i>ACTION SPECIFIC</i> Prohibits lethal concentrations of pollutants in the mixing zone	May be applicable to discharges of wastewater on-site to jurisdictional surface waters.
Water Quality Criteria	UAC R317-1	applicable	<i>ACTION SPECIFIC</i> Definitions and general requirements	May be applicable to discharges of wastewater on-site to jurisdictional surface waters..

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REQUIREMENT	CITATION	STATUS	DESCRIPTION	NOTES/ACTION TO ATTAIN REQUIREMENT
Standards of Quality for Waters of the State	UAC R317-2	applicable	ACTION SPECIFIC Numeric criteria for surface water quality	May be applicable to discharges of wastewater on-site to jurisdictional surface waters.
Underground Injection Control Program	UAC R317-7	applicable	ACTION SPECIFIC Conditions under which wastes may be injected underground	A re-injection alternative is possible in the future to protect the West Jordan City well field. If this alternative is considered in the future, the appropriate regulations must be met.
Utah Pollutant Discharge Elimination System	UAC R317-8	applicable	ACTION SPECIFIC Establishes substantive requirements limiting point source discharges to surface waters, including monitoring and compliance with technology-based effluent limitations, new source performance standards, toxic effluent standards, and water quality based standards	Insertion of treatment concentrates into the tailings line for disposal in the tailings pond (both considered on-site) must not cause the discharge from the tailings pond to violate its permit. May be applicable to other potential on-site discharges to jurisdictional surface waters, such as post-mine closure discharge of treatment residues.
Utah Air Conservation Regulations				

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REQUIREMENT	CITATION	STATUS	DESCRIPTION	NOTES/ACTION TO ATTAIN REQUIREMENT
Permit: Notice of Intent and Approval Order Requirements for Approval Orders General Requirements, Emission Standards National Emission Standards for Hazardous Air Pollutants Emission Impact Analysis	UAC R307-401 UAC R307-401-6 UAC R307-101 R307-201-1 UAC R307-214 UAC R307-410	applicable	<i>ACTION SPECIFIC</i> Regulates new installations which will or might reasonably be expected to become a source or indirect source of air pollution.	Applicable if on-site water treatment plant or other installations will or might reasonably be expected to become a source of air pollution. NESHAPs may be relevant and appropriate depending upon facility design and source categories regulated.
Fugitive Dust and Emission Standards	UAC R307-309	applicable	<i>ACTION SPECIFIC</i> Requires controls in Salt Lake County, and any other non-attainment area for PM10: fugitive emissions and fugitive dust	Applicable if remediation activities result in fugitive dust or emissions.
State Engineer, Department of Natural Resources				

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<i>REQUIREMENT</i>	<i>CITATION</i>	<i>STATUS</i>	<i>DESCRIPTION</i>	<i>NOTES/ACTION TO ATTAIN REQUIREMENT</i>
Well Drilling Regulations	UAC R655-4	applicable	<i>ACTION SPECIFIC</i> Standards for drilling and abandonment of wells as well as performance standards	Applicable to well drilling activities.
Ground Water Management Plan		applicable	<i>ACTION SPECIFIC</i> Limits the volume of ground water withdrawals to prevent mining of Groundwater. Requires withdrawals to be distributed over the valley to ensure that localized interference and water quality problems do not result.	Applicable to remedies requiring Groundwater withdrawals. Would have to meet limits or petition the State Engineer for a modification of the ground water management plan. A petition to create Institutional Controls for the project area, to manage the future development of water rights and to control enhancements upon existing rights, would have to be provided to the State Engineer for approval.
Utah Hazardous Waste Regulations				
Definitions and General Requirements - Identification and Listing of Hazardous Waste.	UAC R315-1 R315-2	applicable	<i>ACTION SPECIFIC</i> Standards for identifying and listing hazardous waste	Applicable for determining whether wastes generated during remedial activities are hazardous wastes.*

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<i>REQUIREMENT</i>	<i>CITATION</i>	<i>STATUS</i>	<i>DESCRIPTION</i>	<i>NOTES/ACTION TO ATTAIN REQUIREMENT</i>
Facility Standards	UAC R315-8-2.9 and 2.10 R315-8-6 R315-8-7 R315-8-9 and 10 R315-8-12 R315-8-14 40 C.F.R. 264.554	applicable/ relevant and appropriate	<i>ACTION SPECIFIC</i> Facility siting criteria and construction quality assurance program; Ground water protection; Closure/post closure; use and management of containers; and tanks; standards for waste piles; standards for landfills; standards for staging areas	These standards are applicable for hazardous wastes generated during remedial activities, treated, stored or disposed of on-site. These standards may be relevant and appropriate for Bevill exempt wastes that exhibit a characteristic of hazardous waste (Characteristic Bevill Waste) treated, stored or disposed of on-site.
Generator Standards	UAC R315-5	applicable	<i>ACTION SPECIFIC</i> Hazardous waste generator standards	Generator standards are applicable to extent hazardous wastes are generated during remedial actions.
Emergency Controls	UAC R315-8-9	applicable/ relevant and appropriate	<i>ACTION SPECIFIC</i> Standards for notification and response to spills of hazardous wastes	Applicable if reportable amount of hazardous waste is spilled during remedial actions. May be relevant and appropriate if reportable amount of a Characteristic Bevill Waste is spilled during remedial actions.
Land Disposal Standards	UAC R315-13	applicable/ relevant and appropriate	<i>ACTION SPECIFIC</i> Restrictions on land-based disposal of hazardous wastes	Applicable if hazardous wastes are disposed on-site; may be relevant and appropriate if a Characteristic Bevill Waste is disposed on-site.

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REQUIREMENT	CITATION	STATUS	DESCRIPTION	NOTES/ACTION TO ATTAIN REQUIREMENT
Cleanup Action and Risk-Based Closure Standards Rule	UAC R315-101	applicable/ relevant and appropriate	<i>CHEMICAL SPECIFIC</i> Risk-based closure standards for management of sites contaminated with hazardous waste or hazardous constituents	Applicable to hazardous wastes managed on-site; may be relevant and appropriate to Characteristic Bevill Wastes managed on-site.
Corrective Action Cleanup Standards Policy for CERCLA and UST Sites	UAC R311-211	applicable	<i>ACTION SPECIFIC</i> Guidelines for setting cleanup standards, source control and to prevent further degradation	Establishes cleanup standards consistent with other ARARs
Solid Waste Regulations, Subtitle D	UAC R315	applicable	<i>ACTION SPECIFIC</i> Standards for industrial solid waste facilities	Applicable if an on-site repository constructed for wastewater treatment sludges.

* EPA has not made a determination as to whether the treatment residues are a Bevill exempt waste. The remedy calls for the treatment residues to be placed into the tailings line for treatment prior to disposal on the tailings pond. Sampling indicates that the waste that emerges from the tailings line does not fail TCLP. Thus under the mixture rule, the wastes leaving the tailings line would continue to be Bevill exempt regardless of the initial status of the treatment residues. After cessation of mining activities, when the treatment residues will not be treated in the tailings line, the residues will need to be retested to determine if they fail TCLP. If the residues continue to fail TCLP the Utah Hazardous Waste Regulations may be relevant and appropriate.



EXPLANATION OF SIGNIFICANT DIFFERENCES
KENNECOTT SOUTH ZONE OPERABLE UNIT 2
SOUTHWEST JORDAN RIVER VALLEY GROUND WATER PLUMES

U. S. Environmental Protection Agency, Region VIII
999 18th St. Suite 300.
Denver, Colorado, 80202

BACKGROUND

In December, 2000, EPA and UDEQ signed a Record of Decision which selected a remedy for the Zone A ground water plumes associated with past mining activity in the Oquirrh Mountains. During the design phase of the project, Kennecott Utah Copper Corp. (KUCC) conducted treatability studies to refine flows and treatment parameters and to combine the infrastructure associated with this project with similar infrastructure needed to manage other contaminated flows at the mine. These new concepts and study results have led to some minor changes in the selected remedy as chosen by the Record of Decision. The overall approach to the problem and ability to meet the stated objectives remain unchanged.

COMPARISON OF SELECTED REMEDY (as given in the Record of Decision) AND THE REMEDIAL DESIGN (as detailed in the Final Design for Remedial Action)

Remedy in Record of Decision	Remedy in Design Phase	Differences, if any
Operations and maintenance of surface source controls	Not specifically mentioned in the Remedial Design. O+M of the source controls is addressed in a State Ground Water Permit.	Surface source controls not addressed in Remedial Design document. This is required in a State Ground Water Permit.
Integration and use of Institutional Controls, as approved by the State Engineer	Restrictions on use of water from existing wells, restrictions on installation of new wells, moratorium on new water rights will be established through the State Engineer as needed.	The State Ground Water Management Plan issued by the State Engineer in June 2002 addresses issues specific to the remediation effort and needed restrictions in the area of the plumes.
Point of Use Management for private well owners (in-home treatment units, bottled water, deepening of wells, replacement of wells)	Plan for addressing impacts to other well owners was developed. Work with owners to develop best form of reparations.	Same

Remedy in Record of Decision	Remedy in Design Phase	Differences, if any
Plan to deal with consequences of water level drops (new and deeper wells, deeper completions in wells, alternate water sources, purchase or exchange of water rights), well abandonment and compensation.	Options include reduced pumping, replacement water, injection, deeper well installation	Same
Install a barrier well containment system at leading edge of acid plume at points in path of movement (where sulfate is less than 1500 ppm). No water with sulfate concentrations greater than 1500 ppm should move off Kennecott property.	Three wells to serve as an initial barrier well system have already been installed	Same
Install well or wells in core of acid plume	Two wells to operate at any time. Wells moved in response to plume	Same
Pretreatment of acid water using nanofiltration	Acid water sent directly to tailings line without pretreatment. Neutralization and metals removal takes place in the tailings line. Neutralization by tailings can be augmented with lime if needed.	Nanofiltration step eliminated in final design.
Treatment of pretreated acid waters by RO	Not relevant any more	No pretreatment of acid waters. Treatment of acid waters occurs in tailings lines, not by RO plant.
Treatment of water from barrier wells by RO	Treatment of water from sulfate barrier wells by RO	Same

Remedy in Record of Decision	Remedy in Design Phase	Differences, if any
Treated waters to municipal water purveyor	Treated waters from sulfate wells sent to JVWCD, acid waters kept by Kennecott for use in milling processes.	Acid waters are kept by Kennecott for use in processes, and are not sent to a water purveyor.
Install and maintain a monitoring system to track plume movement	Monitoring system plan presented	Same
Prior to mine closure, dispose of concentrates in the tailings line	Acid water and RO concentrates added to tailings line	Very similar
Post Closure plan should be developed during RD/RA which can be implemented quickly.	Post Closure Conceptual design options presented	Same

EXPLANATION OF DIFFERENCES

In the process of designing the remedy, the approach to treating the waters withdrawn from acid plume was changed. Originally, the waters from the acid plume core were to be pretreated using nano-filtration technology. The permeate was then to be further treated using reverse osmosis, with the concentrate recycled to the waste rock dumps for use in active leaching of the waste rock. However, since this approach was studied and advocated, Kennecott discontinued the active leaching of waste rock. This makes the concept of re-use of the concentrate for leaching no longer available. With the cessation of active leaching, Kennecott began experimentation on treatment of the residual leachate and leachates produced with precipitation falls on the dump areas. A study during the design phase indicated that insertion of the acid waters into the tailings pipeline was feasible. The tailings, which contain carbonates, were able to neutralize the acids. The tailings line, therefore, serves as a 13-mile long acid neutralizing facility. The neutralization capacity is required in the tailings line whether the nano-filtration concentrate waters are neutralized or the acid plume waters themselves are neutralized. Further studies revealed that the neutralization process was actually completed in the first few hundred yards of the pipeline. The experiments further proved that both waste streams, the residual leachate water from the dumps and the acid waters removed from the aquifer, could be treated effectively in this manner. The resulting water with its soluble components is not of drinking water quality and therefore will not be provided to the municipalities. Instead, it would be recycled and used in Kennecott's processing, especially at the Copperton Concentrator. One of the principles in the National Contingency Plan (NCP) indicates that water generated by treatment of contaminated aquifers should be put to beneficial uses. Although the water will not go to municipal culinary use, it will have a beneficial use as industrial water.

Calculations have also revealed that treatment of the acid plume is not cost-effective because the acid plume is of such poor quality. Although such a scheme was proposed in the RI/FS and agreed to in the ROD, only 24% of the acid plume waters would actually go to drinking water and the rest would end up in the tailings pipeline (and then for industrial use). For this small volume of drinking water product, the cost would be about \$6-7/1000 gals. Treatment of the less contaminated waters at the barrier wells is much more cost-effective and can be done with less waste of the water. The cost of treatment of barrier well water is \$0.70/1000 gals.

In terms of operations of the barrier well reverse osmosis treatment plant in Zone A, Kennecott will construct and operate the plant for the first 5 years at least, perhaps longer. This is to allow time for Kennecott to develop the operational parameters and costs so that long-term management negotiations can proceed. Kennecott may choose to operate the plant indefinitely so that the facility can be expanded and integrated with Kennecott's industrial water management system. As is the original plan, the treated water from the reverse osmosis plant will go to JWWCD and the treatment concentrate to the tailings line.

Scientists agreed very early that effectiveness of source control infrastructure was extremely critical in cleaning up the aquifer. The cut-off walls and pipelines associated with these source control measures were constructed and are now maintained through provisions of a state groundwater protection permit. Because of its importance to the cleanup program, maintenance of these source controls was listed as an element of the ROD of December, 2000. The source control maintenance is not described in the remedial design because this is already included in the groundwater permit. The parties remain committed to this part of the remedy. Maintenance of the source control facilities will continue either under the auspices of the groundwater permit or under terms of the federal RD/RA Consent Decree.

CONCLUSIONS

Although some of the treatment details presented in the Remedial Design are different than detailed in the ROD, the overall approach remains unchanged. Unchanged is the concept of barrier wells which prevent spread of the contamination. Unchanged is the withdrawal of the heavily contaminated waters from the core of the acid plume so that the plume diminishes in size over time. Unchanged is the approach for beneficial use of the waters withdrawn from the plume, a concept which works for both the waters treated in the reverse osmosis plant and in the tailings pipeline.

APPROVED:

Max H. Dodson
Assistant Regional Administrator
Office of Ecosystems Protection and Remediation
U. S. Environmental Protection Agency, Region VIII

6-23-03

Date

Dianne R. Nielson, Ph.D.
Executive Director
Utah Department of Environmental Quality

7/20/03

Date

Explanation of Significant Differences

Kennecott South Zone, Operable Unit 2 Southwest Jordan River Valley Ground Water Plumes

U.S. Environmental Protection Agency, Region 8
Utah Department of Environmental Quality

June 2007

Introduction

The Kennecott South Zone Site, proposed for the National Priorities List (NPL) in 1994, is located in southwestern Salt Lake County, Utah, about 10 miles southwest of Salt Lake City. Operable Unit 2 (OU2) of the Site, known as the Southwest Jordan River Valley Ground Water Plumes, encompasses the groundwater beneath all or portions of the municipalities of West Jordan, South Jordan, Riverton, Herriman, and portions of unincorporated Salt Lake County. A Record of Decision, selecting a remedy for OU2, is dated December 13, 2000.

The remedy was modified with an Explanation of Significant Differences (ESD) in August 2003. This June 2007 Explanation of Significant Differences is the second ESD to modify the original remedy. While the overall approach to this Site, and the ability to meet stated objectives, remains unchanged, certain refinements to the original remedy (as modified by the first ESD) are necessary.

This Explanation of Significant Differences (ESD) describes the rationale for modifying the remedy specified in the Record of Decision (ROD) and first ESD for Operable Unit 2 of the Kennecott South Zone Site. Section 117(c) of CERCLA, 42 USC §9617(c), and the National Contingency Plan (NCP), 40 C.F.R. Section 300.435(c)(2)(i) require that an ESD be prepared when the differences in the Remedial Action significantly change but do not fundamentally alter the remedy selected in the ROD with respect to scope, performance, or cost.

This ESD is supported by and will become part of the Administrative Record file for this Site, in accordance with the NCP, Section 300.823(a)(2). The Administrative Record is available for review at UDEQ's office located at 168 North 1950 West, Salt Lake City, Utah. Key documents and reports are also available for review at the City Recorder's Office, City of West Jordan, 8000 South Redwood Rd, West Jordan, UT 84088.

Site History

The Kennecott South Zone Site is composed of historic mining sites, of surface areas contaminated by mining wastes which migrated from source areas downgradient to cities and towns, and of subsurface areas contaminated by acid leachates from the mining district. The Kennecott South Zone Site is comprised of fifteen operable units.

The remedy selected for the Kennecott South Zone Operable Unit No. 2 – Southwest Jordan Valley Groundwater Plumes, involves treatment and containment of contaminated ground water. The principal sources which caused the ground water contamination have been addressed in previous actions or are managed by Kennecott under provisions of a Utah Ground Water Protection Permit.

The selected remedy, as modified by the first ESD, contains the following elements:

- Continuation of source control measures as administered through the State of Utah Ground Water Protection Program.
- Prevent human exposure to unacceptable high concentrations of hazardous substances and/or pollutants or contaminants by limiting access to the contaminated ground water. The State Ground Water Management Plan, issued by the State Engineer in June 2002, addresses issues specific to the remediation effort and needed restrictions in the area of the plumes.
- Prevent human exposure to unacceptable high concentrations of hazardous substances and/or pollutants or contaminant through point-of-use management which includes providing in-house treatment units to residents with impacted wells, replacement of their water by hooking the properties up to municipal drinking and/or secondary supplies, and/or modifying their wells to reach uncontaminated waters.
- Contain the acid plume in Zone A by installation of barrier wells at the leading edge of the contamination (1500 ppm sulfate or less), pump and treat the waters to provide a hydraulic barrier to prevent further plume movement while providing treated water for municipal use. The treatment technology for the barrier well waters is reverse osmosis.
- Withdraw the heavily contaminated waters from the core of the acid plume in Zone A and send it directly to the tailings line. Neutralization and metals removal takes place in the tailings line. Neutralization can be augmented with lime if needed.
- Monitor the plume to follow the progress of natural attenuation for the portions of the Zone A plume which contain sulfate in excess of the primary drinking water standard for sulfate (500 ppm sulfate).
- Disposal of acid water and reverse osmosis concentrates in existing pipeline used to slurry tailings to a tailings impoundment prior to mine closure.
- Development of a post-mine closure plan to manage extracted acid core water and reverse osmosis treatment concentrates (derived from the management option selected for the water extracted at the leading edge wells) for use when the mine and mill are no longer operating.

Basis for and Description of the Significant Differences

A number of clarifications to the remedy are required to address barrier well water management, source control measures for the Eastside Collection System and Bingham Reservoir, and performance standards.

1) Water Management

The December 2000 ROD selected treatment of barrier well water using reverse osmosis and delivery of treated water to a municipal water purveyor. This clarification to the remedy is to allow other management options for barrier well water including continued use by Kennecott for industrial needs or the provision of raw or treated barrier well water for any other lawful use that is both consistent with the quality of the water, previous decision documents and acceptable to EPA and UDEQ.

2) Source Control Measures

The original remedy indicates that source control measures (i.e., Eastside Collection System, Bingham Reservoir) are to be operated under State permits. As a clarification, these permits are considered complimentary to the OU2 remedy and management of the Southwest Jordan Valley Groundwater plumes. UDEQ will provide routine reports to evaluate compliance with State permits. In the event that State permits and/or programs are ineffective in controlling potential sources of contamination to the groundwater plume, additional Federal CERCLA response actions may be required. At a minimum, Kennecott's compliance with applicable State permits will be evaluated no less often than every five years pursuant to the CERCLA requirement to conduct a Five Year Review whenever waste is left in place precluding unrestricted use and unlimited exposure.

3) Performance Standards

There are three performance standards related to the rate of extraction from the core of the plume in Zone A, plume containment, and cleanup levels to demonstrate the effectiveness of the remedy.

A) Extraction Rate

Several wells have been installed for the extraction of heavily contaminated water from the core of the acid plume in Zone A. The change in this ESD is to define a rate of extraction to assure reduction in the size of the contaminated plume. As of the time of the writing of this ESD, that extraction rate has been established at a minimum of 1200 acre-feet per year from the core of the acid plume, on a five-year rolling average. The extraction rate may be modified pursuant to the Operation, Maintenance and Replacement (OM&R) Plan.

B) Containment

Another change from the 2000 ROD is that a series of compliance points has been established along the northern, eastern, and southern boundaries of the Zone A Plume. These points of compliance are identified in the OM&R Plan. The points of compliance may be modified pursuant to the OM&R Plan.

C) Cleanup Levels

The final cleanup levels for active remediation are given in the following table:

FINAL CLEANUP LEVELS FOR ACTIVE REMEDIATION

Contaminant	Cleanup Levels Throughout the Acid Plume (dissolved concentrations)
pH	pH = 6.5 – 8.5
Arsenic	0.05 mg/l
Barium	2 mg/l
Cadmium	0.005 mg/l
Copper	1.3 mg/l
Fluoride	4 mg/l
Lead	0.015 mg/l
Selenium	0.05 mg/l
Nickel	0.1 mg/l
Sulfate*	1500 mg/l

* Once sulfate has reached 1500 mg/l throughout the plume, active remediation may be discontinued in favor of monitored natural attenuation until sulfate concentrations throughout the plume reach 500 mg/l.

Nitrate has been deleted as a contaminant of concern since nitrate concentrations have consistently been well below the groundwater protection limit.

Treatment levels for the reverse osmosis treatment plant have been deleted since the water treatment plant is operating under a permit with the Utah Division of Drinking Water.

The method for determining when final cleanup levels have been met will be identified in the OM&R Plan when the groundwater quality in the plume approaches the final cleanup levels.

Comments from Utah Department of Environmental Quality

The Utah Department of Environmental Quality (UDEQ) supports EPA's decision to modify the remedy for Operable Unit 2 of the Kennecott South Zone Site.

Public Participation

EPA published a notice in the Deseret News and Salt Lake Tribune newspapers that described the ESD and its availability for review (under Section 117(c) of CERCLA, 42 U.S.C. Section 9617). While a formal public comment period is not required when issuing an ESD, EPA and UDEQ provided an opportunity for the public to comment. Following a 30-day comment period, a responsiveness summary was prepared in response to comments received. This ESD, and all documents that support the changes and clarifications, are contained in the Administrative Record of the Kennecott South Zone Site (under 40 CFR, Section 300.435(c)(2)(i)).

Statutory Determinations

Under CERCLA Section 121, EPA must select a remedy that is protective of human health and the environment, complies with Applicable or Relevant and Appropriate Requirements (ARARs), and is cost effective. EPA believes that the modifications to the ROD for the Southwest Jordan River Valley groundwater plumes are appropriate and the remedy will remain protective of human health and the environment. The selected remedy will continue to comply with federal and state requirements that are applicable and relevant and appropriate to the remedial action. This ESD does not fundamentally change the remedy and is cost effective.

Section 121 also states that EPA must select a remedy that uses permanent solutions, alternative treatment technologies, or resource recovery technologies to the maximum extent practicable. In addition, CERCLA prefers remedies that include treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous waste as a principal element of the remedy. The selected remedy uses treatment as a principal element in remediation of the aquifer and meets the statutory requirement.

6.12.07

Date

Carol Rushin
Assistant Regional Administrator
Ecosystems Protection and Remediation
US EPA Region 8

6/8/07

Date

Dianne R. Nielson, Ph. D.
Executive Director
Utah Department of Environmental
Quality

**SOUTH FACILITIES GROUNDWATER
OPERATION, MAINTENANCE, AND REPLACEMENT PLAN
JUNE 2007**

1.0 INTRODUCTION

Kennecott Utah Copper Corporation (KUCC) is currently conducting groundwater remediation at its South Facilities as selected by the U.S. Environmental Protection Agency (EPA) and the Utah Department of Environmental Quality (UDEQ) in a Record of Decision (ROD) dated December 13, 2000 for the Kennecott South Zone, Operable Unit 2. In response to the ROD, KUCC submitted a Final Design for Remedial Action (RDRA) in December 2002. EPA approved the RDRA and issued an Explanation of Significant Differences (ESD) on June 23, 2003. EPA and UDEQ issued a second ESD on June 12, 2007 modifying certain aspects of the selected remedy.

KUCC has completed construction of facilities required to implement the selected remedy; EPA and UDEQ certified Construction Completion for these facilities on June 7, 2007. This Operation, Maintenance, and Replacement (OM&R) Plan addresses post-construction remedial aspects of the ROD and has been prepared as an attachment to the Consent Decree for the South Facilities Groundwater. This OM&R Plan supersedes the RDRA.

Groundwater contamination at the South Facilities, referred to as Zone A Plume, is immediately downgradient of the old Bingham Reservoir and Bingham Canyon Mine waste-rock dumps and consists of a core area with low pH and elevated metals which is surrounded by a partially to fully neutralized zone of elevated-sulfate groundwater.

Post-construction OM&R activities include:

- Containing the plume using barrier wells and wells in the core of the plume,
- Remediating the aquifer through extraction of contaminated water and natural attenuation,
- Management of extracted groundwater and disposal of treatment residuals,
- Mitigating, as appropriate, impacts to third parties,
- Maintaining institutional controls to prevent public exposure, and
- Monitoring and reporting progress.

Maintenance of source control measures, namely the East Side Collection System, is a related activity that is being addressed under state permitting controls.

2.0 OM&R PLAN CHANGES

South Facilities Groundwater OM&R activities are expected to last for several decades. Given the length of time over which this remedy will be conducted, it is likely that changing conditions in the aquifer, advancements in treatment technology, eventual cessation of mining and milling operations, or other factors will, from time to time, warrant adjustments to this OM&R Plan.

EPA and UDEQ may approve modification of this OM&R Plan. Such modification shall not require court approval or amendment to the Consent Decree so long as the modification does not fundamentally change or materially alter the basic components of the remedy selected or modified in accordance with CERCLA or the NCP.

3.0 OM&R PROJECT MANAGEMENT

3.1 KUCC Project Coordinator

KUCC will designate a Project Coordinator who will have direct responsibility for day-to-day OM&R oversight. The Project Coordinator is KUCC's main point of contact for communications between KUCC and the agencies.

If the designated KUCC Project Coordinator is changed, KUCC will inform EPA and UDEQ of the identity of the successor at least 15 working days before the change is made, unless impracticable, but in no event later than the actual day the change is made.

3.2 Supervising Contractor

In the event KUCC delegates complete OM&R oversight to a Supervising Contractor, KUCC will notify EPA and UDEQ in writing of the name, title, and qualifications of any contractor proposed to be the Supervising Contractor. KUCC will demonstrate that the proposed contractor has a quality system that complies with ANSI/ASQC E4-1994, "Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs," (American National Standard, January 5, 1995), by submitting a copy of the proposed contractor's Quality Management Plan (QMP). The QMP will be prepared in accordance with "EPA Requirements for Quality Management Plans (QA/R-2)" (EPA/240/B-01/002, March 2001) or equivalent documentation as determined by EPA and UDEQ.

4.0 CONTAINMENT AND EXTRACTION OF CONTAMINATED GROUNDWATER

KUCC has constructed five wells and associated infrastructure for the purpose of containment and extraction of Zone A contaminated groundwater. These include two wells in the core of the Zone A plume (acid wells) and three barrier wells located along the leading edge of the Zone A plume (Figure 4.1). KUCC is currently and will continue to extract groundwater from the Zone A Plume until Final Clean-up levels as outlined in the June 2007 ESD are achieved.

4.1 Operation and Maintenance

KUCC will operate and maintain the barrier wells in order to extract groundwater at a rate that is at least sufficient to contain the Zone A plume and meet the performance standard of maintaining groundwater sulfate concentration in the Compliance Wells at or below 1,500 mg/l. KUCC may pump at a greater rate than is necessary for containment as needed to provide feed water to the RO Plant or to provide water for other uses within the scope of KUCC water rights assigned to the barrier wells.

KUCC will operate and maintain the acid wells to extract groundwater from the plume core at a rate sufficient to meet or exceed the minimum extraction criterion of 1,200 acre-feet per year, calculated on a 5-year rolling average.

KUCC will set and adjust extraction rates and well-field geometry as necessary according to monitoring and modeling results in order to contain the plume, optimize contaminant extraction, and balance the hydraulic response of the aquifer (drawdown) with the need to protect the ability of the aquifer to transmit plume water to the wells.

4.2 Replacement

Based on modeling results and monitoring data, KUCC has demonstrated that the present well field geometry is adequate to meet the performance standards for containment and remediation. However, KUCC may construct replacement, alternatively located, or additional extraction wells or reduce the number of extraction wells as warranted to optimize groundwater remediation and assure containment.

5.0 MANAGEMENT OF EXTRACTED GROUNDWATER

5.1 Barrier Well Water

For the duration of KUCC's obligation under an agreement with the State of Utah and the Jordan Valley Water Conservancy District (JVWCD) dated August 31, 2004, KUCC plans to manage barrier well water primarily by providing it as feed water to a reverse osmosis (RO) treatment plant. KUCC may also utilize barrier well water in its process water system, as it has done for many years. Other management options for water extracted from the barrier wells could include providing the water for secondary use (irrigation), or any other lawful use and disposition of such water. KUCC will advise EPA and UDEQ of any changes in the use and disposition of barrier extraction well water.

5.2 Acid Well Groundwater

During operation of the Bingham Canyon Mine, KUCC will rely on operating milling facilities for treatment of acid plume water, specifically a) the tailings pipeline, which serves as a 17-mile treatment reactor; b) the Copperton Concentrator lime plant, which has ability to add hydrated lime directly to the tailings line as needed, and c) the North Tailings Impoundment, which provides a repository for non-hazardous treatment residuals. Management of treatment residuals in the North Tailings Impoundment is

subject to compliance with State of Utah UPDES Permit UT0000051 and Groundwater Discharge Permit UGW350011.

5.2.1 Operation and Maintenance

Acid plume water is conveyed from the acid wells to the tailings line where it is neutralized by 1) available alkalinity of the tailings (primarily present as calcite in the limestone portion of the ore), and 2) residual hydrated lime added as a milling reagent. KUCC may also add lime directly to the tailings pipeline if needed for neutralization. Acid water pipelines and other conveyance structures will be inspected and maintained as needed to prevent release of extracted acid water.

5.2.2 Replacement

Treatment of acid plume water is expected to continue beyond closure of the Bingham Canyon Mine (currently anticipated between 2018 and 2030). The current KUCC plan for post-mining management of acidic flows is based on lime treatment of acidic waters with disposal of reaction products (i.e., gypsum sludge) in a prepared facility.

KUCC will continue to investigate alternative treatment technologies, particularly ones that have the potential to decrease both lime consumption and sludge volumes. The plan for post-mining water management and disposal of treatment residuals will be updated formally as part of the 5-Year Reviews during Remedial Action. At least three years prior to closure, KUCC will prepare a preliminary engineering design for all aspects of post-closure acid plume water treatment. Prior to mine closure a replacement treatment system and repository for treatment residuals will be designed and constructed.

6.0 MITIGATION OF IMPACTS TO THIRD-PARTIES

KUCC will maintain a program to evaluate and address concerns by third-party water rights holders related to Zone A groundwater quality or extractions. If a complaint is received, either directly by KUCC or indirectly through a regulatory agency, KUCC will gather and evaluate water quality and quantity data and water right seniority information related to the issue. KUCC may also refer the matter for an independent review by a consultant. The results of this evaluation will be reviewed and discussed with the third party, EPA, UDEQ, and the Utah Division of Water Rights (State Engineer). If a third-party impact is attributable to KUCC's remedial program, KUCC or the independent consultant will recommend potential mitigation with the water right holder and regulatory agencies. If acceptable to the water right owner, the mitigation will be implemented.

This process is designed to address concerns of third-party water right holder regarding potential interference with pre-existing water rights utilizing criteria consistent with Utah law. Nothing in the process is intended to create, modify, expand, limit, or restrict the legal rights or remedies of either the water right owner or Kennecott.

7.0 MAINTENANCE OF INSTITUTIONAL CONTROLS

KUCC has initiated institutional controls to prevent public exposure to contaminated groundwater. First, a drilling restriction on certain lands (Figure 7.1) owned by KUCC will be utilized to restrict the drilling of any well that would extract, or is capable of extracting, water. This restriction will be consistent with the Utah Environmental Institutional Control Act, which provides UDEQ with authority to enforce the restriction.

Second, the Utah Division of Water Rights Salt Lake Valley Groundwater Management Plan provides for critical review of any application to change point-of-diversion or drill a replacement well in the contaminated area defined in the Management Plan so as not to interfere with the remediation process.

KUCC will assist with maintenance of these institutional controls by actively monitoring applications filed with the Division of Water Rights in the contaminated area and working proactively with the Division of Water Rights and the UDEQ as appropriate, to control the drilling of wells that would interfere with the remedy.

8.0 MONITORING AND REPORTING

8.1 Monitoring

KUCC will conduct water quality monitoring at a network of compliance wells to demonstrate compliance with the performance standard for containment of the Zone A plume and at the remedial extraction wells to measure progress towards achieving final clean-up levels. KUCC may also conduct supplemental monitoring at its discretion. A monitoring plan is included as Appendix A. Monitoring will continue until final clean-up levels are achieved.

8.2 Annual Reports

KUCC will prepare and submit annual reports on OM&R monitoring, remedial activities, and remedial progress. All groundwater monitoring information collected as part of the remedial effort will be included in the annual report. Annual reporting (in a format to be specified by the agencies) will be prepared on a calendar-year basis, and an annual report will be submitted to EPA and UDEQ by April 15 of the following year. The annual report will include a summary of monitoring results and other compliance activities for the source control measures.

Separate from the report described above, KUCC will prepare and submit to EPA and UDEQ by April 15 of each year an annual summary of activities related to 1) third-party inquiries and KUCC's responses, and 2) maintenance of institutional controls.

8.3 Other Reports and Notifications

KUCC will make timely notifications or submit ad hoc reports as needed to inform EPA and UDEQ of significant changes in either operating strategy or groundwater conditions.

To support completion of Five-Year Reviews by the agencies, KUCC will provide timely response to reasonable requests from EPA or UDEQ for information relevant to Zone A plume remedial activities.

8.4 Determination of Achievement of Final Clean-Up Levels

Final clean-up levels to be achieved as a result of the Zone A plume remedial activities are specified in the June 2007 ESD. At a future date when KUCC believes that final-clean up levels have been achieved or could soon be achieved, KUCC will propose to EPA and UDEQ appropriate statistical, analytical, and/or other methodology for determination of achievement of the final clean-up levels.

8.5 Abandonment of Wells

At such time that Kennecott, EPA, and UDEQ determine that any monitoring well(s) is no longer needed for monitoring of the Zone A plume remedial progress and if the well(s) is not required for some other regulatory purpose, KUCC will, within a reasonable period, abandon the well(s). Abandonment of monitoring wells will conform to Utah Division of Water Rights rules.

9.0 SOURCE CONTROLS

KUCC has constructed source control measures that include a series of cut-off walls, french drains, pipelines, and canals to capture and convey meteoric leach water from the waste rock dumps. Maintenance and monitoring of source controls is addressed in KUCC's Utah Ground Water Discharge Permit UGW350006 for the Bingham Canyon Mine and Water Collection System.

The source control measures will be operated pursuant to the state Ground Water Discharge Permit conditions. Any non-conformance with the permit will be addressed solely as specified in the permit and state groundwater protection permitting rules. As part of the five-year review process, EPA and UDEQ will evaluate the effectiveness of the groundwater protection permit in assuring maintenance of source controls

10.0 RECORDS RETENTION

Until 10 years after KUCC receives a notification from EPA of Certification of Completion of the Work pursuant to the terms of the Consent Decree, KUCC will maintain the following records and types of records:

1. The final version of the Remedial Investigation/Feasibility Study and appendices dated March 16, 1998.
2. The final version of the Final Design for Remedial Action at South Facilities Groundwater dated December 2002.
3. All final versions of subsequent design documents related to replacement of extraction or treatment systems necessary to implement the post-construction requirements

4. EPA's Record of Decision dated December 13, 2000 for Kennecott South Zone, Operable Unit 2.
5. EPA's Explanations of Significant Differences, Kennecott South Zone Operable Unit 2, signed by EPA on June 23, 2003 and June 12, 2007.
6. Any subsequent Record of Decision amendments or Explanation of Significant Differences documents.
7. The Remedial Action Consent Decree.
8. Any subsequent Consent Decree modifications or amendments.
9. This OM&R Plan and any subsequent revisions or replacements.
10. All final versions of annual OM&R reports, which will include all relevant groundwater monitoring data.
11. All subsequent agency approvals of plans, modifications, reports, etc.
12. Annual groundwater extraction records for KUCC wells and any available extraction records for neighboring wells that are needed for calibration of groundwater models.
13. Well drilling and construction records.
14. Key geologic data and evaluations including geologic maps, geologic cross sections, geophysical survey results, geologic and geophysical well logs.
15. Any other scientific or technical data or studies relating to geology, hydrogeology, or water treatment that may be deemed to have enduring relevance to the project and are so designated by the KUCC Project Coordinator.

Until the completion of each five-year review, KUCC will maintain all reports submitted during the five-year review period pursuant to compliance with the state permits referenced in this OM&R plan.

For purposes of this section, records, reports, or documents (records) can include either electronic or written/paper documents; however, the requirement to retain such records does not apply to both forms, but to either form at the discretion of KUCC.

11.0 REFERENCES

Kennecott Utah Copper Corporation, 2002, Final Design for Remedial Action at South Facilities, Groundwater, December.

Kennecott Utah Copper Corporation, 2005a, Groundwater Characterization and Monitoring Plan, Revision 7, February.

Kennecott Utah Copper Corporation, 2005b, Standard Operating Procedures for Water Sampling, Revision 5, March.

Kennecott Utah Copper Corporation, 2005c, Quality Assurance Project Plan for the Groundwater Characterization and Monitoring Plan, Revision 6, March.

United States Environmental Protection Agency, 2000, Record of Decision for Kennecott South Zone, Operable Unit 2, Southwest Jordan River Valley Ground Water Plumes, December 13, 2000.

United States Environmental Protection Agency, 2003, Explanation of Significant Differences, Kennecott (South Zone) OU2, June 23, 2003.

United States Environmental Protection Agency, 2007, Explanation of Significant Differences, Kennecott (South Zone) OU2, June 12, 2007.

APPENDIX A
MONITORING PLAN

SOUTH FACILITIES GROUNDWATER MONITORING PLAN

VERSION	PREPARED	APPROVED	EFFECTIVE
1	June 2007	June 2007	July 1, 2007

1.0 PURPOSE

This plan describes the monitoring that KUCC will conduct as part of the South Facilities Groundwater Operation, Maintenance, and Replacement Plan (OM&R Plan). This monitoring plan is based on and replaces in whole the monitoring plan presented in the *Final Design for Remedial Action at South Facilities Groundwater* (RDRA) dated December 2002.

The purpose of monitoring at South Facilities Groundwater is to:

- 1) demonstrate compliance with the performance standard for containment of the Zone A plume,
- 2) measure progress toward achieving final clean-up levels, and
- 3) gather supplemental monitoring data which benefits KUCC in managing and optimizing its groundwater remediation and treatment program.

It is expected that this monitoring plan will be revised on a regular basis in response to changes observed in the plume over time.

2.0 METHODS

KUCC's Groundwater Characterization and Monitoring Plan (GCMP), as updated, and associated Standard Operating Procedures (SOPs), as updated, will be followed for all water quality sampling and water level measurements. The GCMP has been approved by the Utah Division of Water Quality and is updated on an annual basis. Procedures for documentation and sample handling, equipment maintenance and decontamination, quality control sampling, field measurements, and groundwater sampling are detailed in the SOPs. All water quality analyses will be conducted by Kennecott Environmental Laboratory or another state-certified environmental laboratory.

3.0 REQUIRED MONITORING

The monitoring described in this section fulfills the monitoring needs specified in the June 2007 ESD to demonstrate compliance with performance standards and monitor progress of remediation. Performance of this monitoring is subject to enforcement under the Consent Decree.

3.1 Locations

Required monitoring consists of sampling at a network of Compliance Wells on the perimeter of the Zone A plume and at the remedial Extraction Wells within the plume. These wells are listed in Table 3.1 and shown on Figure 3.1.

Table 3.1 Required Monitoring Locations

Well	Type
COG1178A	Compliance
WJG1169A	Compliance
WJG1154A	Compliance
W189	Compliance
P192B	Compliance
P194B	Compliance
EPG1165A	Compliance
BSG1135A	Compliance
HMG1123A	Compliance
HMG1126A	Compliance
ECG1146	Extraction
BSG1201	Extraction
B2G1193	Extraction
BFG1200	Extraction
LTG1147	Extraction

3.2 Sample Frequency and Timing

The sampling frequency and timing for Compliance Wells is dependant on sulfate concentration as shown in Table 3.2.

Table 3.2 Compliance Well Sampling Frequency and Timing

Sulfate (mg/l)	Frequency	Timing*
<1,000	Annually	3rd Quarter
1,000-1,250	Semi-annually	1st and 3rd Quarters
>1,250	Quarterly	Each Quarter

*Reference to quarters here and subsequently are based on calendar-year quarters

When sulfate concentrations decrease from a higher sulfate range to a lower sulfate range, required sampling frequency will decrease after two consecutive periods with sulfate concentrations in the lower range.

Extraction wells will be sampled semi-annually in 1st and 3rd quarters.

3.3 Parameters

The parameters to be monitored at the Compliance Wells and Extraction Wells are those listed in the June 2007 ESD for which a final clean-up level is specified. These parameters are listed in Table 3.3.

Table 3.3 Compliance and Extraction Well Monitoring Parameters*

pH
Arsenic (D)
Barium (D)
Cadmium (D)
Copper (D)
Fluoride
Lead (D)
Selenium (D)
Nickel (D)
Sulfate

*(D) means dissolved

3.4 Reporting

All monitoring data for Compliance and Extraction Wells will be reported annually as described in the OM&R Plan.

If any water sample from a Compliance Well exceeds the 1,500 mg/l sulfate criterion, KUCC will notify in writing EPA/DEQ of probable out-of-compliance status within 10 working days of receiving official laboratory analytical results. (Informal verbal notification will be provided as soon as practical after KUCC becomes aware of the results.) KUCC will have the opportunity to re-sample the well within 5 working days of making written notification to EPA/DEQ.

3.5 Replacement

KUCC will make diligent and reasonable effort to retain designated Compliance Wells; however, it is recognized that development pressures and other factors may require abandonment of some Compliance Wells. Prior to abandonment of any Compliance Well, KUCC will recommend to and seek approval from EPA/DEQ for a replacement well, which may be a reasonably adjacent existing well or a new well within reasonable proximity of the well to be abandoned.

4.0 SUPPLEMENTAL MONITORING

The purpose of the supplemental monitoring described below is to benefit KUCC in managing and optimizing its groundwater remediation program. Performance of this monitoring is not subject to enforcement under the Consent Decree. Supplemental monitoring data may also be used to demonstrate, at an appropriate future date, achievement of the final clean-up levels.

4.1 Water Quality and Water Level Monitoring

Within and adjacent to the Zone A plume are over 300 monitoring wells, in addition to the Extraction and Compliance wells listed above. KUCC may select

and conduct water quality and/or water level monitoring on any number of these wells each year. Water quality samples will be analyzed for those parameters that KUCC believes useful to managing the remedial program.

4.2 Ground Surface Elevation Monitoring

KUCC monitors ground surface elevation at selected locations on a regular basis to detect land surface elevation changes that may be caused from groundwater extraction. Current surface elevation monitoring points are listed in Table 4.4. KUCC may add or remove sites from this list as necessary.

Table 4.4 Locations for Ground Surface Elevation Monitoring

Well Site ID
K105
ECG1116
ECG1124
BSG1180
BFG1156
WJG1170
BSG1137
1973 West
¼ Section 13/14
¼ Section 15/22

4.3 Tailings Monitoring

KUCC monitors the solid and aqueous chemistry in the tailings system to assure that acid plume waters and other mining-affected waters which are managed in the tailings line do not adversely impact the process water system or the long-term acid-generating potential of the tailings.

4.3.1 Locations

Monitoring of the solid and aqueous phases of the tailings slurry and discharged water to the tailings slurry is conducted by sampling at two locations in the tailings system. Composite samples for solid and aqueous phase monitoring are collected once a month over a 24-hour period 1) at the GMT (general mill tailings; BCP1483) entering the Tailings Thickeners Distribution Box and 2) at the NSB (North Splitter Box; MCP2536). The GMT sample is collected from the automated sample cutters that sample Copperton Concentrator tailings. The GMT sampler automatically samples the waste stream every 20 to 30 minutes. The NSB composite sample is collected using a peristaltic sampling pump on the tailings line approximately 200 feet upstream of the NSB. The pump is programmed to sample every 20 minutes.

The aqueous pH of tailings is monitored continuously at the North Splitter Box.

4.3.2 Parameters

Solid tailings samples are analyzed for neutralization potential (NP) following standard methods. Aqueous samples are analyzed for the parameters listed in Table 4.7.

Table 4.7 Process and Tailings System Aqueous Monitoring Parameters

pH
Alkalinity/Acidity
Aluminum (D)
Cadmium (D)
Copper (D)
Iron (D)
Manganese (D)
Zinc (D)

4.3.3 Management Criteria

KUCC utilizes the following management criteria in management of acidic waters in the tailings system:

1. The neutralization potential (NP) value of samples collected from the tailings North Splitter Box should be either greater than or equal to the NP of Copperton Mill Tailings for the month or at least 5 t CaCO₃ eq/kt. The monthly NP values will be determined based upon a 24-hour composite sample and using a six-month rolling average. In making comparisons, the uncertainty in both GMT and NSB will be taken to be 10% of the average value, and a significant difference must lie outside the joint uncertainty.
2. Aqueous alkalinity should be greater than or equal to 10 mg CaCO₃ eq/L at least 90% of the time. Aqueous alkalinity will be evaluated as a rolling six-month average.
3. The aqueous pH at the North Splitter Box should be greater than or equal to 6.7 during at least 90% of the time over a calendar year.

5.0 REGISTER OF CHANGES

Version	Date	Changes
1	June 2007	Initial release





